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approach

approach looks at aviation weather

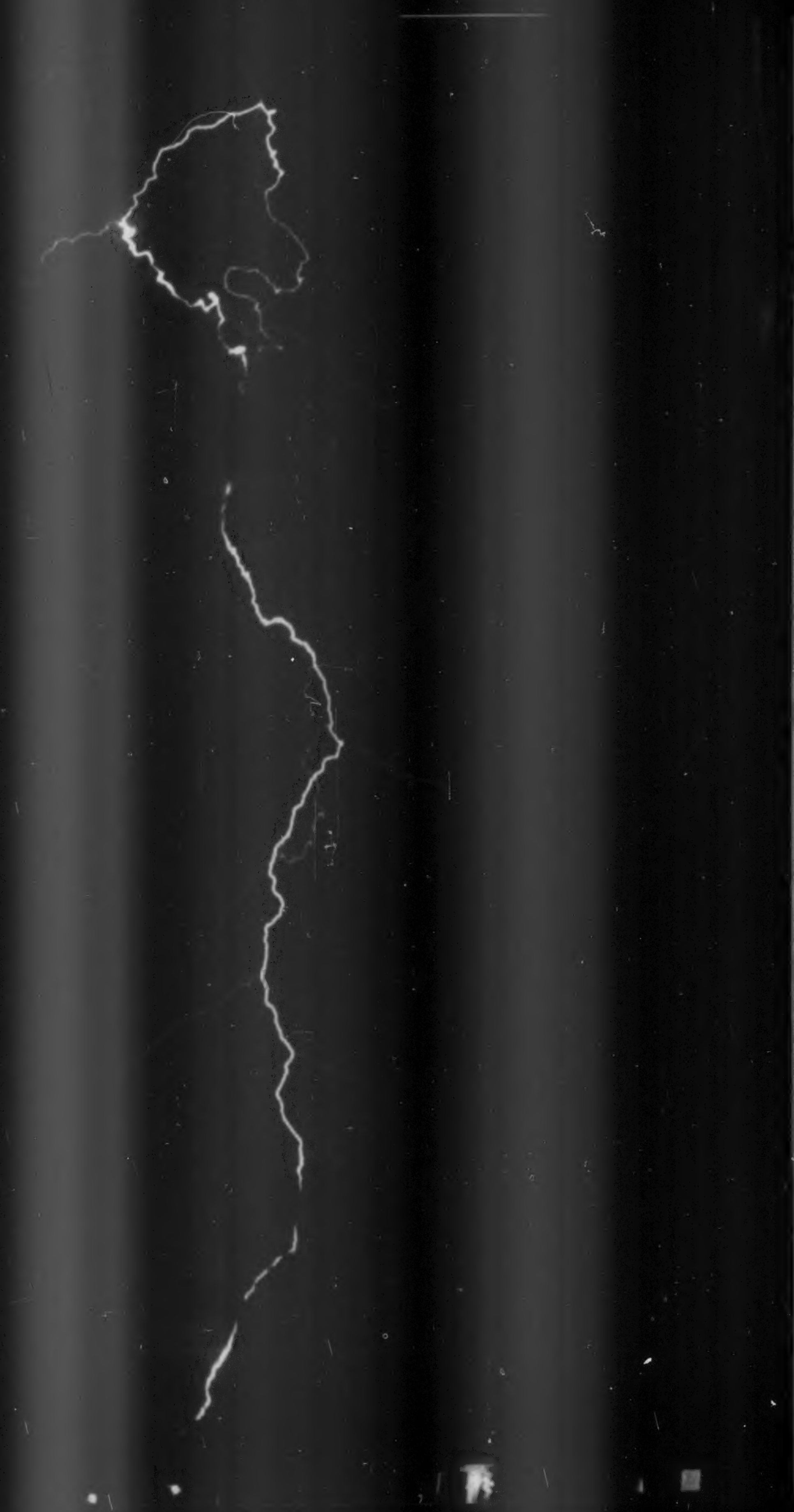
EDITORIAL

WEATHER can have a big impact on how a flight goes. No one wants to fly around in IMC conditions or in thunderstorms. Where most aviators get in trouble is overconfidence in coping with various convective weather phenomena such as thunderstorms and the like. This can-do spirit causes carrier qualification and mission priorities to overcome common sense. How many of you have sat in ready rooms with the field weather marginal at best, with an even more marginal divert, and with the entire base playing "chicken" to see who's going to cancel first?

There were 32 weather related Class A, B and C mishaps between 1982 and 1987. Of these, 54 percent involved judgment errors, particularly in weather avoidance. You know the kind — afterwards everyone asks, "What were they flying in that stuff for?" Mother Nature still packs a wallop. The best edge you can have is to give her a wide berth when she's in a bad mood.

This special look at aviation weather describes adverse convective weather phenomena from both a technical perspective and from the cockpit. Since we uncovered so much material, we've split it into two editions. The second edition will be published in the fall. We owe an enormous debt of thanks to Cdr. Joe Towers for his indefatigable efforts to assemble the best material for this special issue. Cdr. Towers himself is a foremost expert on the subject, and his counsel has been invaluable. This issue would have never been conceived without his unselfish and persistent help.

LCdr. Dave Parsons
Editor



inside approach

Vol. 33 No. 10

Weather Ahead!
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Back cover
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FEATURES

DEPARTMENTS

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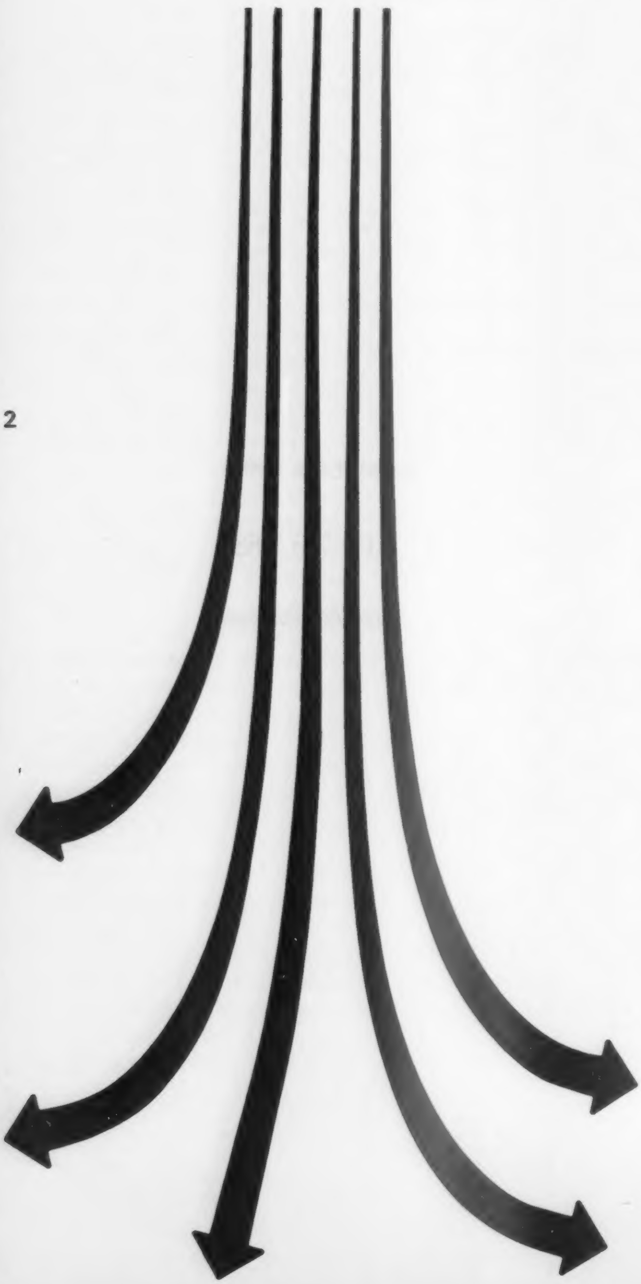
WEATHER SPECIAL

The Microburst and Naval Aviation

By Cdr. Joseph F. Towers



THE pilot breathed a welcome sigh of relief. Intrepid 415 had just broken out below a churning, hell-black overcast. Beneath, a torrential downpour beat furiously upon the fighter, obscuring forward visibility as rivers of water streamed across the windscreen.

Jarred by gusty winds, the cockpit instruments indicated an erratic angle-of-attack as the airspeed started a rapid rise. The resultant increase in lift lessened the rate of descent and ballooned the aircraft to well above glide path. Instinctively adjusting pitch attitude, the pilot corrected back to the desired slope while the auto-throttles overcompensated in reducing the thrust levers.

A fleeting thought passed, a vague recollection of an unusual meteorological phenomenon, but was quickly discarded. Besides, it was only of concern to transport types.

The craft began to shudder as the powerful winds shifted violently, unpredictably and dangerously. Yet, it was only a typical, late afternoon summer storm.

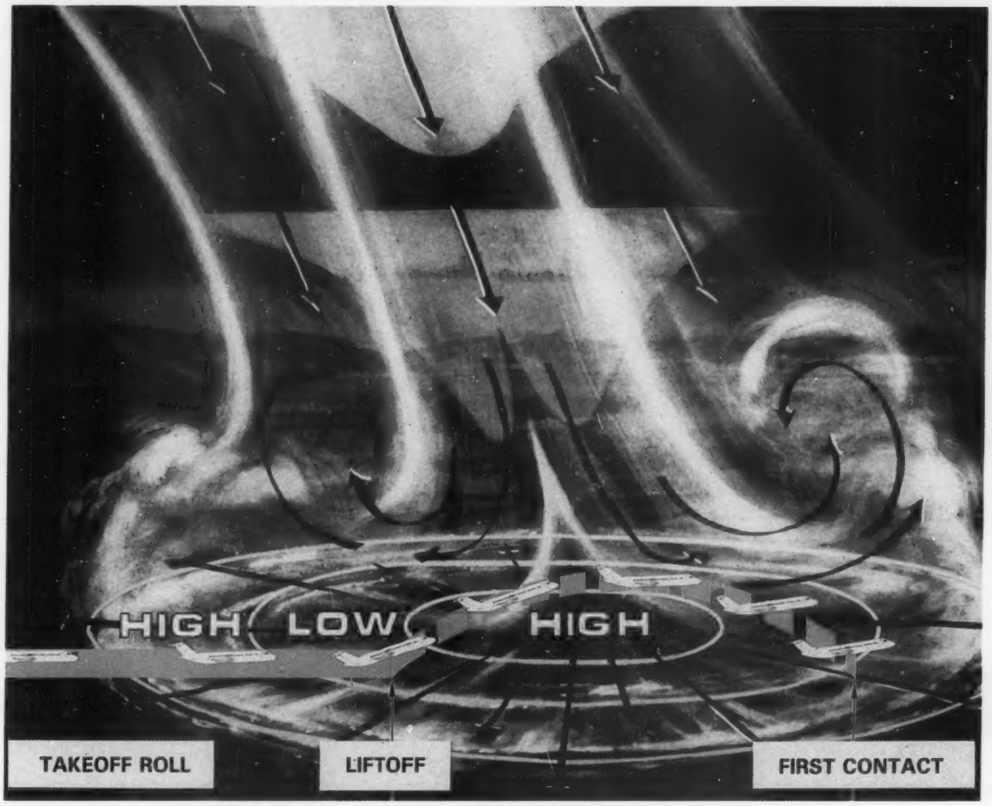
Developing a rapid descent, going well below glide slope, 400 feet, how could things change so fast? Auto-throttles disengaged, a little power ought to do it; besides, no approach is so bad that it can't be salvaged . . . still sinking, drifting left, more power, have to break that descent, glide slope? . . . lineup . . . more power, 100 feet — **BURNER**!

Time seemed to stop. Then that cold, sweaty, nauseous sensation followed. It was like a nightmare compressed into a single instant. Finally, he realized what he'd hated and feared — knowing that he'd lost control of a critical situation.

"I've lost it! **Eject, eject, eject!**"

A bright orange fireball, thick, billowing black smoke and total disintegration was observed one-half mile short of the threshold. No parachute emerged. There was no chance of survival, not in that burning, fragmented wreckage.

Fortunately, this mishap didn't occur. Or did it? Possibly it's buried as some obscure remnant in aviation past? Could it be a premonition of a future event?



Shown is a three-dimensional illustration of a microburst with an added overlay of high and low static pressure regions.

Naval aviation is not immune to the deadly, convectively-spawned microburst. Naval aircraft do not take exception to the laws of physics and aerodynamics. Several mishaps have undoubtedly occurred with microburst-induced windshear as a probable cause. As a result of inconclusive analysis and evidence, however, no mishaps have been officially attributed to the phenomenon. Perhaps many of these mishaps are statistical casualties hidden under the umbrella of "flight crew error" or "unknown."

A microburst, the smallest and most lethal of the downburst family, is an intense, highly localized downward atmospheric flow. It is classically spawned by convective parent clouds, occupies a small geographical area, and has a life span of only a few minutes.

During its descent, a microburst is about 1-km wide. As it approaches the earth's surface, it diverges horizontally in an asymmetrical pattern of violent, powerful wind radiating out to 4-km in diameter and 1,000 feet high.

Downdraft velocities may be in the range of 2,000 to 5,000 fpm. These velocities decrease in intensity as they near the surface, theoretically going to zero. At some height above the earth, the downward energy is transferred laterally, generating outflow wind velocities from 20 to 100-plus knots. As the lateral winds move outward from the high-pressure stagnation core that forms at the center of the microburst, their velocities first increase and then gradually decrease.

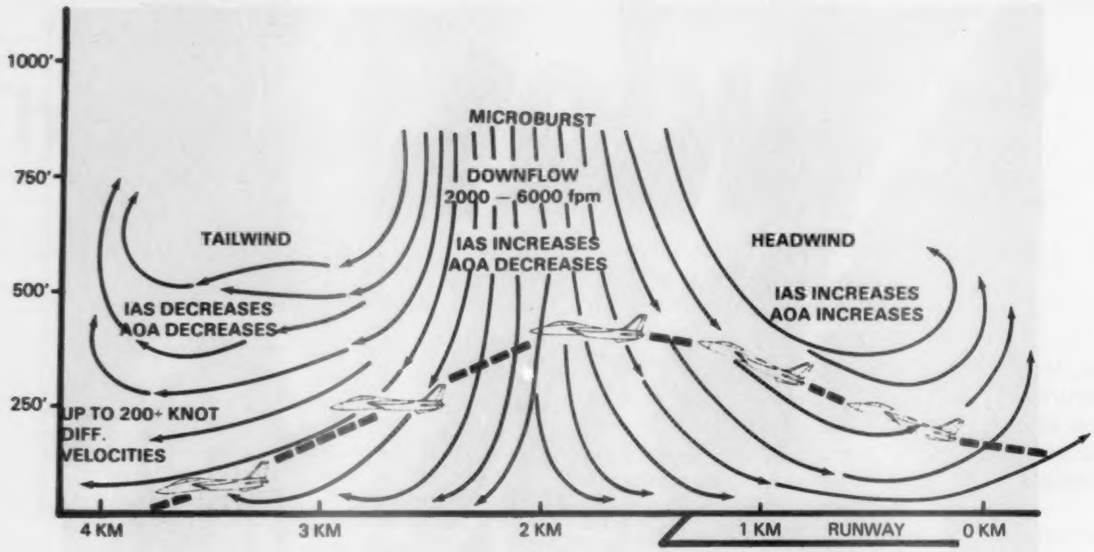
After the diverging flow first hits the earth's surface, a doubling of its intensity to maximum occurs within five minutes. Maximum intensity may then be sustained up to five minutes before dissipation.

During this time if a microburst is accidentally encountered and safely negotiated, there is no assurance that the next aircraft will be able to safely traverse it. Microbursts often develop in groups or families of two or more, so the presence of one is a signal that others are likely to occur.

There are two basic types of microbursts, wet and dry. Both are relatively common. The wet one is associated with heavy rainfall at the surface. This type may be present when any of the following conditions exist beneath a convective cloud base:

- torrential rain
- isolated rainshower
- defined rainshaft
- wall of frontal rain
- horizontal vortex ring
- variable gusty winds

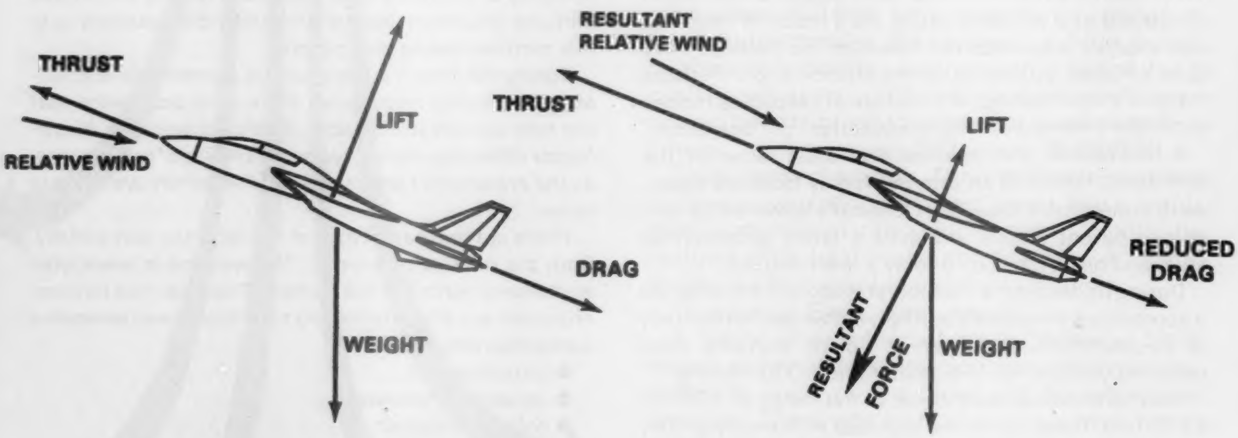
Do not attempt a takeoff or approach through an isolated shower or rainshaft associated with torrential



Consider this atmospheric disturbance with the anticipated changes in longitudinal stability and flight profile of an aircraft under a constant thrust setting and neutrally trimmed condition. Initial head wind during penetration will result in significant increases in IAS and AOA, producing an increased performance profile. As the aircraft then penetrates the downflow and tail wind areas, critical losses of IAS and AOA will occur. These combined reductions will severely impair the aircraft's ability to generate life and sustain flight, thereby resulting in a Decreased Performance Profile.

If the aircraft is not developing sufficient lift to support its weight, the resultant vector (of lift, weight, thrust and drag) will create an unbalanced force to gravitationally accelerate the craft in the downward vertical plane as an equilibrium condition is sought. During this transition, the flight profile is adversely altered. If such an oscillation is not interrupted by the flight crew or if the negative vertical displacement exceeds altitude available, ground impact can easily occur.

Two serious complications arise: (1) the accuracy of pressure sensitive instruments, such as the altimeter and vertical speed indicator, has NOT been determined during microburst penetration, and (2) assuming that the flight crew can achieve favorable stabilization, there would come a second order of effect that would require that the aircraft climb rate exceed the rate of descent of the descending airflow in order for a net climb rate to result, relative to the ground.



Shown here are the four forces of acceleration on an aircraft in flight. During microburst penetration, these forces can become unfavorably unbalanced due to a transitory reduction in lift. The result is an adversely altered flight profile as the aircraft transitions to an equilibrium condition.

rainfall. A low-altitude windshear condition could develop that may exceed the aerodynamic capability of your aircraft.

The other type, the dry microburst, may contain little or no rain at the surface. It is often associated with innocent looking virga beneath a high altitude convective cloud base and usually develops in the dry climate common in the western states. Virga is an often beautiful phenomenon resulting from the evaporation of precipitation as it falls through the atmosphere. During the evaporation process, the already cold downdraft is cooled further, increasing its density and accelerating it further. Current investigation indicates that some microbursts may be induced solely by this type of evaporative cooling of raindrops under certain atmospheric conditions.

Envision a microburst encounter during takeoff and how it might appear from the cockpit of a non-angle-of-attack aircraft. Indicated airspeed may start to fluctuate erratically, followed by a decreasing vertical speed trend on the vertical speed indicator, altimeter and radar altimeter, and a reduction in pitch attitude.

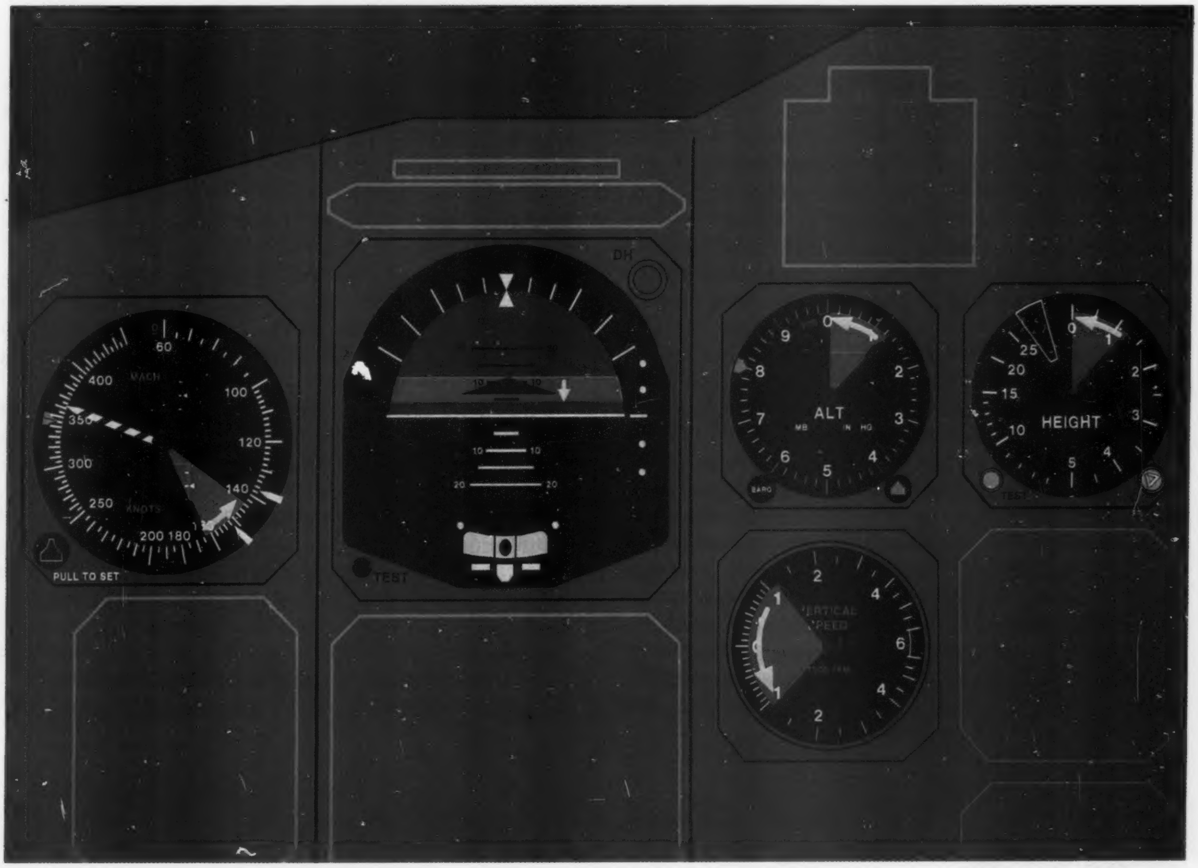
In such an instance, do not reduce pitch attitude in an attempt to recover indicated airspeed. This could result in a further reduction in angle-of-attack, a high rate of descent, altitude loss and even possible impact. Instead, use all available excess thrust to accelerate the aircraft.

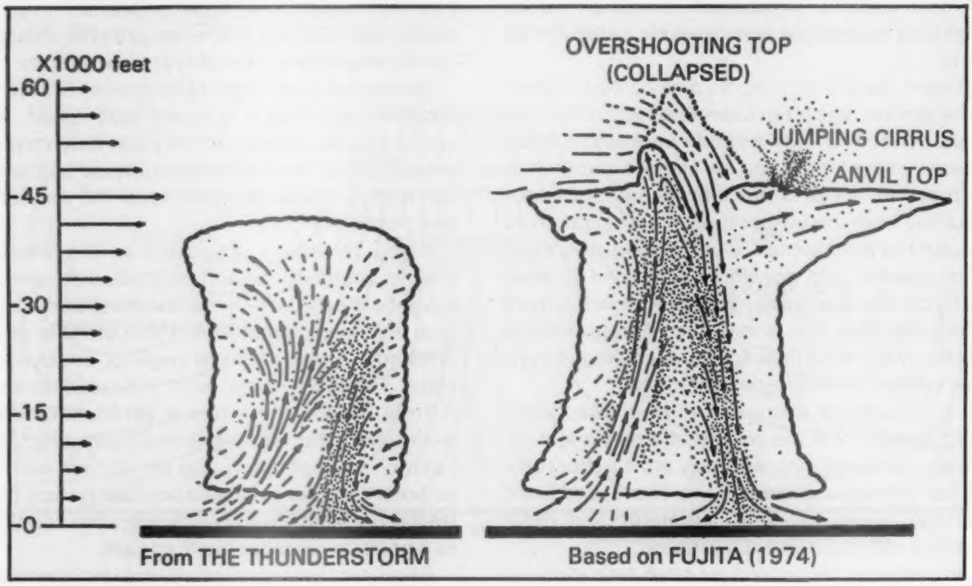
Remember that flight-path control is crucial and that airspeed, provided it is above stall speed, should be a secondary consideration. The pitch-down tendency of the aircraft, if not immediately countered by the flight crew, can lead to a rapid degradation of the vertical flight path and possible impact.

If you fly into a suspected severe microburst, you should rotate to takeoff attitude and simultaneously advance the thrust levers to the mechanical stops regardless of engine limitations. Pitch attitude should be increased to attain a greater angle-of-attack and lift coefficient. Rotation, even with indicated airspeed below normal, is a counter-intuitive, yet crucial, crew response. In simulator training, pilots find it very difficult to keep the "plane" from going in. Set an attitude and hold it. The turbulence is so great that concentration becomes extremely difficult. Primary concentration should be devoted to a positive climbout pitch attitude.

Be aware that substantially greater control column forces will be required as the aircraft becomes more out of

This instrument panel shows the primary indications of a deteriorating flight path. Do not reduce pitch attitude in an attempt to recover indicated airspeed since this can result in a further reduction in angle of attack and a high rate of descent. Instead, use all available excess thrust to accelerate the aircraft.





Here is a classical illustration of the intense updrafts and downdrafts associated with thunderstorms. Dr. T. Theodore Fujita, Department of Geophysical Science, University of Chicago, claims that when an overshooting top rises and then collapses rapidly, a microburst can form on the downwind side of the dome. The downdraft may be fed by fast moving stratospheric air above the anvil as the overshooting top collapses. Microbursts may also be induced by isolated showers from relatively small, rapidly expanding, but relatively short-lived parent clouds. Lightning and thunder may or may not be present. Supercell thunderstorms are inducers of strong tornadoes and microbursts.

trim. Twenty to 30 pounds of back pressure, roughly equivalent to initial rotation, is common and should be used. Some aircraft may have reduced elevator authority, depending on stabilizer trim, air loads and the degree of airspeed decay. This condition could prevent or inhibit rotation until the horizontal stabilizer is retrimmed.

If a descent rate exists below 500 feet, smoothly increase the pitch attitude to attain a positive rate of climb. If necessary, use intermittent stick shaker as the upper pitch attitude limit. This is a recovery technique to be used in an extremely critical situation to achieve a kinetic energy exchange for a short-term performance gain to reduce the probability of ground impact. This technique applies to non-angle-of-attack aircraft during both takeoff and go-around and is given with this warning:

"Stall warning systems are not precise flight instruments. Unnecessary over-rotation to stick shaker can place the aircraft dangerously and permanently close to stall. Rotate only enough to establish a positive climb. Continued rotation to stick shaker should only be attempted if ground impact appears inevitable."

Do not rely on aerodynamic buffet as a pre-stall warning since it may be masked if any turbulence is present. When verifying a positive climb rate on the vertical speed indicator, be aware that this pressure instrument may be erroneous because of variations in atmospheric pressure within the microburst. Always cross reference the radar altimeter.

Autopilot engagements in pitch modes should not be selected since attitude will be adjusted to achieve command airspeed selection. If your aircraft has a flight director, disregard pitch command inputs since the "V" bars will command pitch attitude reductions during low-speed maneuvering to attain V(ref) or V_2 and can artificially inhibit deck angles when a higher pitch attitude may be required.

Fast/slow speed indexes available on some flight directors should not be referenced during this flight regime. The technique recommended for non-angle-of-attack aircraft is a crude attempt to optimize flight-path direction for an aircraft that is not properly instrumented for this condition. All future generation transport aircraft should use angle-of-attack indicators and advanced heads-up displays (HUDs) with velocity vectors indicating flight path direction, pitch guidance and pitch limit indicators.

The indiscriminate chasing of indicated airspeed without cross-reference to other instrumentation courts dis-

aster. During the highly dynamic conditions of microburst flight, airspeed is an inferior and invalid parameter for adequately deciphering the entire aerodynamic picture.

What about the angle-of-attack aircraft during an approach?

As the outflow is penetrated, warning signs may include an erratic or increasing angle-of-attack, a rapid climb in indicated airspeed, a reduction in descent rate and a ballooning float to above the glide slope. The reduction of thrust and pitch attitude to correct back to the glide slope is a typical but deadly mistake.

Expect trouble in this situation and immediately execute a go-around. Should a suspected severe microburst be encountered:

- Rotate to go-around attitude, and simultaneously
- apply maximum thrust, including the selection of afterburner.

If a descent rate exists below 500 feet, continue rotation, referencing angle-of-attck, to attain a positive climb rate.

Use optimum AOA as the upper pitch attitude limit. Expect an erratic and possibly unusable angle-of-attack.

Aircraft having an advanced HUD should reference their velocity vector for flight-path direction.

This recovery maneuver applies to angle-of-attack-equipped aircraft during both the approach and takeoff.

In this highly dynamic encounter, expect continuously changing flight deck angles greater than those required during normal takeoff and go-around.

If a positive climb rate cannot be initially achieved or sustained, attempt to fly out in no less than a level-flight condition. Once downward acceleration has developed, an aggressive and extraordinary force is required to overcome it, one which may be nearly impossible for any energy-deficient aircraft to generate, especially when given very limited time and altitude constraints.

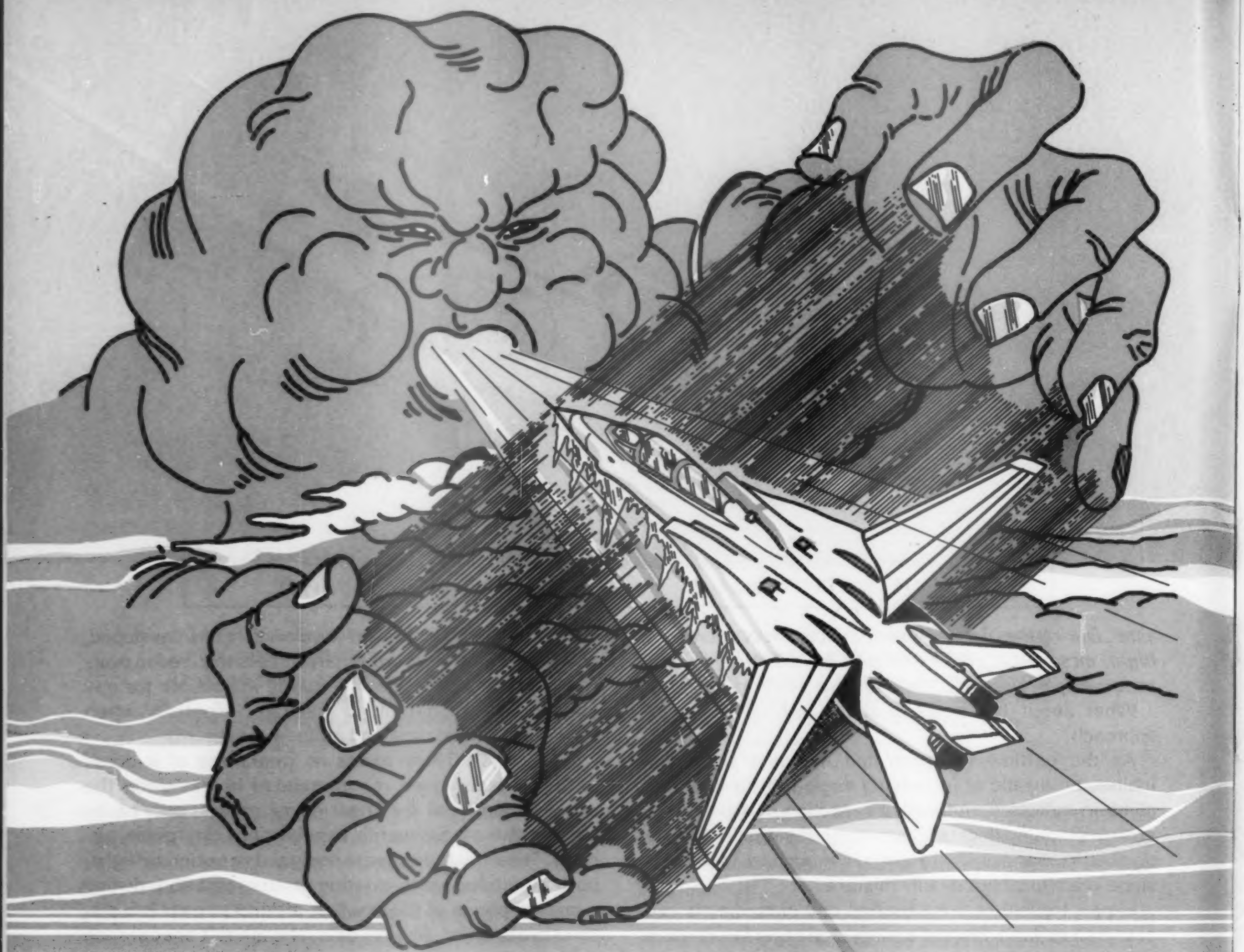
WARNING: There exists no guarantee of success with the techniques recommended herein since the physical forces of the shear or microburst may easily exceed the aerodynamic capability of any given aircraft. These techniques are designed to optimize flight-path direction, using existing instrumentation, during a critical phase of flight when ground impact is a distinct probability. Always delay the takeoff or approach if any reason exists that a potentially dangerous condition may be present.

The problem with microburst conditions is that because the relative wind is changing so dramatically in both velocity and direction, it may easily exceed the pilot's or aircraft's ability to safely negotiate it! The aircraft may not be able to accelerate proportionately to compensate for the rate of change of the relative wind.

The microburst is a powerful atmospheric disturbance which poses an indisputable danger for all aircraft. During your flying career, you may encounter one or more microbursts. The outcome will depend on the intensity of the microburst, your aircraft's vulnerability at the time of the encounter and your ability to control flight-path direction. And you may have less than 5 to 10 seconds to recognize the situation and respond accordingly!

Any way you play this game, remember — it's a stacked deck . . . one played against all odds! ●

Cdr. Towers is a San Diego-based first officer on the B-767 with American Airlines. He has studied and written extensively on the phenomenon of microburst-induced windshear for the last five years. A reserve naval aviator, he is an instructor pilot in the C-9 with VR 57 at NAS North Island, Calif.



. . . In front of our aircraft was the most ominous looking black wall that ever spanned this aviator's windscreen . . .

Terror In a Frozen Tomcat

By LCdr. John Stufflebeem

THIS sortie involved two F-14s versus two A-4s in a dissimilar air combat training (DACT) hop on the Yuma Tactical Air Combat Training System (TACTS) range. Takeoff from NAS Miramar and transit to and from the TACTS range were routine. The DACT was successful and fun, but the descent to landing at homeplate was not.

On the return my section of Tomcats was handed off to Approach and received the appropriate check-in information. We were warned about a line of thunderstorms over the mountains to the east of Miramar (not unusual) and of a storm over the field accompanied by heavy rain requiring a change of the duty runway from 24 to 6 (*very unusual*).

Weather was above circling approach minimums, and my wingman and I decided to split for radar vectors to GCAs to runway 24, circling to land runway 6. A call to Miramar METRO confirmed that a heavy rainstorm was over the field but moving east. The freezing level was 11,000 feet, and the thunderstorms over the mountains were isolated and not imbedded, pretty much the same as on departure except for the storm over the field.

After separating the section, we were cleared to descend from 16,000 to 11,000 feet on a heading of two seven zero. I selected anti-ice to override, cabin defog to canopy and windshield air before entering the wall of clouds east of the field. Descent from 16,000 to 11,000 feet was in and out of clouds.

After what seemed to be an unduly long level-off at 11,000, we were cleared to 5,000. We went in and out of clouds but did not encounter rain. Before reaching 5,000 feet, we were cleared to 4,000, 3,000 and then 2,000 feet and told to standby for our final controller. In this descent, I dirtied up at 10 DME, completed landing checks and, after popping into the clear, saw an awesome sight.

In front of our aircraft was the most ominous looking black wall that ever spanned this aviator's windscreen. The final controller confirmed that the field was still above circling minimums. Into the darkness plunged our ill-fated fighter, above glide slope. As I pulled a little power to descend onto glide slope, the aircraft was suddenly engulfed in very heavy rain. While still slightly above glide slope, I added a little power to settle onto glide slope, but the vertical speed indicator plummeted at an ever-increasing rate of descent.

On-speed had been calculated to be 131 knots. As the rate of descent continued towards 2,000 feet per minute, I steadily added power and raised the nose until the throttles hit the military stops with the aircraft maintaining an on-speed indication. At this point, the final controller passed a not-so-calm "well below glideslope," the radar altimeter beeped out its 1,000 feet warning and my RIO suggested that it might not be a bad idea to wave off.

Realizing the extremis situation, I crossed-checked the instruments: VSI read 2,000 feet per minute descent, airspeed 120 knots indicated, altitude passing 1,000 feet AGL with a bright amber on-speed doughnut. I looked up but could not see out of either side of the canopy to the wings or in front of the aircraft. I decided that if the rate of descent could not be arrested by 500 feet, we would eject. My RIO called that he could neither see the wings nor the ground.

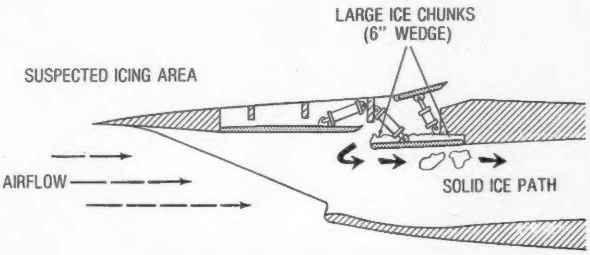
I thought of selecting afterburner, but dismissed it for two reasons: 1. a training command accident I'd heard about that involved a single-engine aircraft adding power in an iced-up condition and having ice both FOD and stall the engine; and 2. an admonition in the cold weather operations portion of the F-14 NATOPS cautioning against the dangers of stalling an engine in the slow airspeed, high RPM regime.

I decided afterward that if faced with the same circumstances, I would select burner due to my low altitude. I was so slow, I had disappeared off the bottom of the GCA scope. I recalled last seeing 800 feet on the radar altimeter in the descent, and my RIO saw 500 feet on his TARPS readout at the bottom of the descent. Luckily, the airspeed quickly began to increase and the rate of descent began to break. Shortly thereafter large ice sheets began sloughing off the windscreen and canopy. The field was now in plain view about two to three miles ahead, and an uneventful circling approach and short field arrestment was made to the runway.

After landing and allowing a few moments for our hearts to restart, we debriefed with METRO. In large storms, strong vertical down drafts can, and apparently did, depress the freezing level well below the advertised altitude. There is no way to predict this occurrence. The only way to avoid it is to *avoid the storm*. I told my trailing wingman about our problems, and he was successful in avoiding the storm by going under it on a contact approach.

Icing effects on an airfoil can be hard to recognize instantly and must be anticipated. In this case, my RIO could not see forward but could see the wings and did not see any ice. I could not see out of the canopy or windscreen due to ice, so there existed either clear ice or ice on the fuselage only (engine and pitot-static instruments appeared normal).

This was our first experience in icing even though both of us have more than 800 hours in type. Having a game plan ahead of time for icing problems is an absolute requirement. My plan is to fly faster than on-speed in a foul weather approach, use MRT as called for, but burner if necessary and avoid big black cells. What's yours?



In addition to the known strong tendency for ice to accumulate at the No. 3 intake ramp diffusor with resultant high engine FOD potential. the acknowledged optimum stall margin throttle setting for all flight regimes of the TF-30 is military power. — LCdr. Dana D. Barclay, F-14 analyst, Aircraft Operations Division, Naval Safety Center.

LCdr. Stufflebeem was flying with VF 211 at the time of this incident. He subsequently transferred to VF 43, flying as an adversary pilot in F-5, A-4 and Kfir aircraft. He is currently back in the F-14 with the VF 102 Diamondbacks.

Breaking t

By Maj. Dave Clary, USAF

. . . I stepped onto the flight deck. I couldn't believe how cold it was. I checked the footing and it was fair with lots of snow and ice, but enough of the nonskid was poking through the ice to prevent a completely slick surface. My airplane was in the process of being de-iced. I talked to the plane captain about removing the ice on the wings, gear doors and squat switches in the wheel wells. I really didn't want to fly. . .

the Chain

THE alarm clock went off. It was set for 0630.

0731: The phone rang. It was the squadron duty officer who told me that I was half an hour late for the 0700 brief. How did that happen? I know I set the clock ahead one hour last night as we passed through the second time zone in two days. I must have forgotten to reset it two nights ago.

0740: I walked into the ready room. What's going on? It's full of enlisted troops taking a military leadership exam. The duty officer apologized for not calling me earlier, but he thought I was briefing next door because of the exam in the ready room. I grabbed the briefing guide, some kneeboard cards and my sleepy wingman who just walked in the door. We went next door to our sister squadron's ready room to brief.

0742: We grabbed a seat and checked the TV for weather and other pertinent info. Weather was 500 overcast, two miles in light snow, winds 280/25, temperature 33 degrees, water temp 40 degrees, sea state 6 feet; intermittently 300 sky obscured, one-half mile in blowing snow. Just great! We had been heading north for over a week, and I knew it was coming, but why today? At least the deck's not pitching and rolling like the day before yesterday. I checked the PLAT TV and more surprises — the flight deck was white. It was covered with snow and ice. I began to feel uneasy.

0755: I finished the brief. I covered all the briefing items in the briefing guide, expanded on a couple of cold weather topics, and found myself wishing I had the whole hour to brief as I normally do. I felt even more uneasy.

0810: I rushed to get into my drysuit, hating every minute of the ordeal of putting it on. I finished reading the book in maintenance control and headed for the roof. Was I hungry! I didn't realize it until then, but I hadn't even had a cup of coffee or a drink of water, not to mention breakfast.

0811: I stepped out onto the flight deck. I couldn't believe how cold it was. I checked the footing and it was fair with lots of snow and ice, but enough of the nonskid was poking through the ice to prevent a completely slick surface. My airplane was in the process of being de-iced. I talked to my plane captain about removing the ice on the wings, gear doors and the squat switches in the wheel wells. I really didn't want to fly.

0820: I strapped into the cockpit. I was parked between elevator 1 and 2. I heard the Tomcat parked in the sixpack (with tailpipes pointed at me) start its engines. I thought flight deck control had agreed not to do that anymore.

Continued

0835: The huffer finally showed up for engine start. Start was normal. I didn't move any controls for at least five minutes until the hydraulic seals and fluid had time to warm up a bit. When the huffer pulled away, I noticed that its exhaust was kicking up chunks of ice and spraying them 50 feet across the flight deck. FOD was going to be a big problem today. As my plane captain and troubleshooters ate Tomcat exhaust fumes, I completed the rest of my before-takeoff checks.

0853: The yellow shirts began to break airplanes down for taxi. I couldn't believe we needed to fly this badly. But I guess we did because the pressure was on. We had been intercepting Bears for four days. Why should today be any different? I almost shut the engine down as the Tomcat's exhaust swept by my intake.

0854: It was my turn to taxi. The blue shirts started to take the chains off. But wait — my attitude indicator was showing an 80-degree climb. It had been good 10 seconds earlier. I called a troubleshooter over to look at it, and we decided the aircraft was down. For the first time today, I felt a little smile coming on. I did not want to fly today. It started to snow heavily.

0856: The attitude indicator righted itself. Now what was I supposed to do? Was the airplane up? Was the mission essential? Was this an accident report in the making?

0857: I told the maintenance chief the airplane was still down.

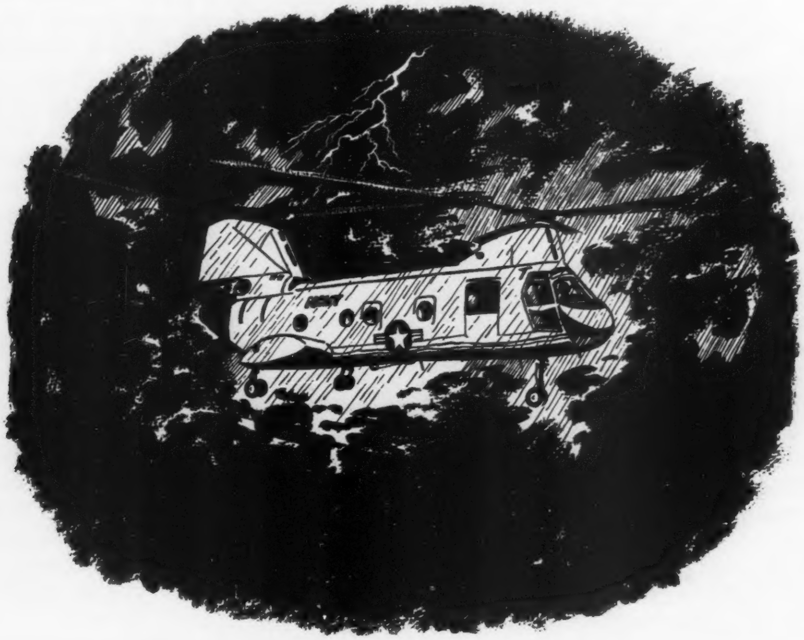
0858: Tower cancelled the entire launch.

From the moment I saw snow on the flight deck on the PLAT TV, I did not have a warm fuzzy feeling about this mission. The late wake up, hurried brief, no breakfast, briefing in different surroundings, marginal weather, first time operating with snow and ice on the flight deck — starting to sound familiar? You always read about those accidents where 10 things had to go wrong before the accident occurred. The reports always say if just one of those things had gone right, or if someone had broken the chain of events, the accident would not have occurred.

You must recognize when this chain is starting to build, and if necessary, you've got to break the chain. Did I break the chain? Did the tower? I don't know. Maybe, maybe not, but the links were there waiting to form the chain.

Maj. Clary is an Air Force exchange pilot assigned to VA 27, flying A-7Es.

. . . I turned the aircraft around and bustered away from the approaching squall. A few minutes later the storm overtook our beleaguered aircraft and pelted us with rain. We encountered significant downdrafts and moderate turbulence . . .



You Gotta Have a Plan

By Lt. Mike Higgins

IT was supposed to be a routine night doppler training flight from NAS Far West to the doppler training area, Snake Island, only five miles away. No frills, just a little of that night proficiency training that everyone needs, then RTB to homeplate. Your typical station SAR crew sat at the brief. I was the HAC, an "experienced" SAR pilot, albeit a first-tour aviator with 600-plus hours, 400 in model (H-46A). The copilot was a "new guy," total pilot time 400 hours. The aft crew consisted of a savvy crew chief and a nugget air crew. The brief covered doppler procedures, lost comms, local weather and emergency procedures. The weather was VFR, scattered light showers. However, it was the beginning of the "monsoon season," an unpredictable and definitely rainy time of the year.

Forty-five minutes after takeoff we were performing one of the last of our required three-a-month night dopplers when I noticed the rain picking up. My copilot and I talked it over and decided to perform our last doppler and give the tower a call to see what was developing with local weather. Tower replied, "VFR, light rain, visibility five miles." The prognosis sounded pretty good. The visibility *was good* because we were at five miles and had no problem seeing the field. I asked tower to check with metro and ask them to give us a call if the weather changed so we could RTB.

We were rolling final on our last doppler. My copilot was doing a super job, and our nugget crewman in the back was getting valuable training talking the crew in toward the smoke float. While in the hover, the crew chief remarked how the rain was getting heavier. My copilot and I agreed. Well, what the heck — we had completed our mission and would have to cut our hop short with 1 + 05 remaining. I called Tower and informed them we were five miles inbound for final landing. Tower rogered and informed us of the heavier rain. The field was VFR.

Geography was never one of my strong points in school or in the brief that night. Unknown to our crew, tower and weather, NAS Far West was going to be hit with a very heavy rain squall. It was the rainy season. The rainy season is a weather-guessers delight; he can safely predict the weather was going to go from good to worse in any 24-hour period and be correct almost all of the time. Rain showers have been reported at NAS Far West that deposited 8 inches of rain per hour. That's enough to slow

your engines down! Back to geography.

Coincidently, I forgot to mention and brief myself and my crew on the "special" relationship NAS Far West has with mountainous terrain. Except for a small slot opening southwest to the sea, NAS Far West is completely surrounded in varying degrees by mountainous terrain. Within 10 NM the highest peak is a little over 3,600 feet. Within a few miles of where we were performing our doppler approaches, the highest peak was about 3,500 feet. Consequently, the minimum en route altitude for radar vectors was approximately 5,500 feet (the height of the highest terrain obstacle plus 2,000 feet).

Getting back to the flight, we decided to cut the flight short with 1 + 05 remaining and RTB to NAS Far West. We completed the landing checklist and reported our VFR checkpoint for final landing.

Tower: "Roger NAS Far West is IFR. Are you requesting special VFR clearance?"

Helo: "That's affirmative." (What the heck, we are the only aircraft in the control zone, and special VFR clearance would entail a five-minute delay at best).

Tower: "Roger 503, stand by for clearance." (No sweat, all we have to do is loiter. After all, we are in sight of the field.)

For special VFR, the pilot must get authorization from air traffic control; visibility must be a minimum of one statute mile. Aircraft other than helicopters, must remain clear of clouds while in the control zone. The pilot and aircraft must be certified for instrument flight when operations are under special VFR. Meanwhile, my copilot and I exchanged worried glances and noted with displeasure that what once was a fairly steady shower had increased significantly into a torrential downpour.

Helo: "Tower, 503, what's the status of the special VFR clearance? Request an update on the weather."

Tower: "Roger, 503, weather reports heavy rain showers and two miles visibility. Stand by for your clearance."

Unknown P-3: "I'm on the numbers and its zero, zero."

Helo: "Roger!" At this point neither I nor my copilot have a warm and fuzzy feeling.

To confirm the anonymous voice report of the P-3 Orion, the runway lights of NAS Far West disappeared behind a wall of rain. Since this particular scenario had never occurred to me, neither I nor my copilot had a plan of action to follow. I turned the aircraft around and bustered away from the approaching squall. A few minutes later the storm overtook our beleaguered aircraft and pelted us with rain. We encountered significant downdrafts and moderate turbulence.

Helo: "Tower, 503, we're IMC switching approach."

Tower: "Roger."

Helo: "Approach, 503, we're IFR five miles NW of the field at 800 feet climbing. Request radar vectors away from mountainous terrain."

Approach: "Roger, stand by."

3710.7L states when weather conditions encountered en route preclude compliance with visual flight rules, the pilot in command shall take appropriate action as follows. You can alter route of flight to continue under VFR conditions, or you can remain in VFR conditions until a change of flight plan is filed and IFR clearance obtained or remain in VFR condition and land at a suitable alternate. Due to lack of foresight, our situation was precarious. We were unable to depart the airport traffic area using a standard instrument departure (SID) or any other instrument procedure. Confidence and familiarity with our "back yard" operating area had been transformed into overconfidence. Confident that the weather would remain just VFR enough for us to squeak home and that our familiarity with the nearby doppler training area would overcome any problems, we had painted ourselves into a cramped corner.

I continued to climb the aircraft at 70 knots and reviewed our options. There weren't many. We were already IFR and unable to remain in VFR, and we were surrounded by mountainous terrain. In short, we were in extremis and needed help desperately to stay away from the mountains and the severe weather.

Helo: "Approach, 503, passing 1,800 feet, request radar vectors away from mountainous terrain."

Approach: "503, Approach, unable to give radar vectors, minimum en route altitude, 5,600 feet. Report level 5,600 feet."

Helo: "Approach, 503, request your assistance to remain clear of the mountains. We are inadvertent IFR and are climbing, heading 270 to avoid mountains." Pilot ego didn't let me say "emergency."

Approach: "503, Approach, unable to give you safe radar vectors until you reach 5,600 feet."

New voice: "503, Approach, steer course 320 report level 5,600."

Helo: "Roger, report level 5,600." At this point I had vertigo so bad I was unable to maintain 70 knots. Fortunately, my copilot did not, and I relinguished control of the aircraft.

Approach: "503, Approach, the field is IFR heavy showers, ½ mile in rain. Say fuel and souls on board."

Helo: "Roger, four souls, 0 + 50."

The rest of the evolution was a routine instrument flight. Approach vectored us around the heaviest parts of the storm, and 20 minutes later we were on GCA short final. Since that flight I have accumulated over 1,200 hours and have since transitioned to another platform. The lesson that I learned that night, and carry with me to this day, is that good head-work combined with NATOPS, a complete knowledge of the aircraft's envelope and a thorough and meticulous brief result in operational readiness. A miscued emphasis on getting the "X" or completing that last doppler may put you in extremis, and if you haven't got a plan, you are way behind the power curve. Our flight was lucky — we had someone there to help us when we really needed it. ●

Lt. Higgins is assigned to HSL 36, NAF Mayport, Fla., and was LAMPS detachment OIC on USS *Connole* (FF 1056) when he wrote this article.

PORTFOLIO

Visual Characteristics of Wind Shear Weather

Photos obtained from Dr. John McCarthy, National Center for Atmospheric Research, Boulder, Colo.

A heavy rain microburst is shown on the left. Horizontal divergence is seen in the rain as it spreads slightly outward near the ground. The view is obscured by rain and reduced visibility.

At right is a classic microburst with heavy rain. The horizontal outflow is seen to the left of the downdraft. The outflow is strong enough to produce the horizontal roll vortex appearing as a bulge in the outflow cloud.

1

2

3

4

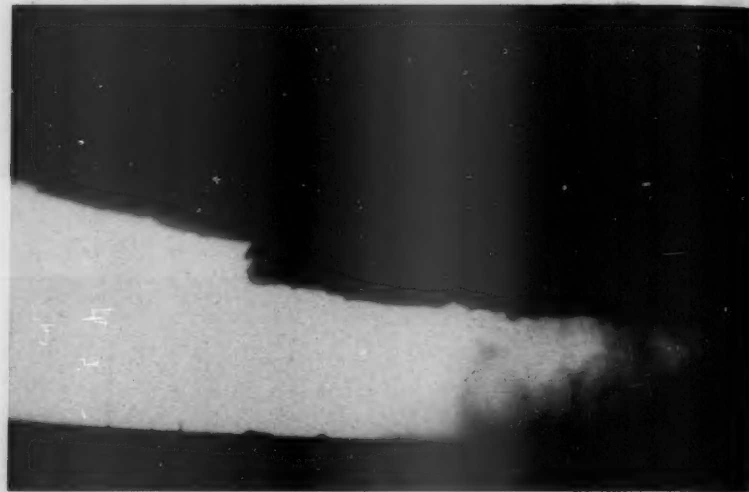
5

A photographic sequence shows the full evolution of a microburst. Photo 1 shows precipitation not reaching the ground (virga) as it falls from a mid-level cloud base. In the second, rain is just reaching the surface with no microburst signatures present. Number 3 pictures an outflow on the left side just beginning with evidence of a horizontal roll vortex. Photos 4 through 6 show the vortex structure of the microburst in two stages

6

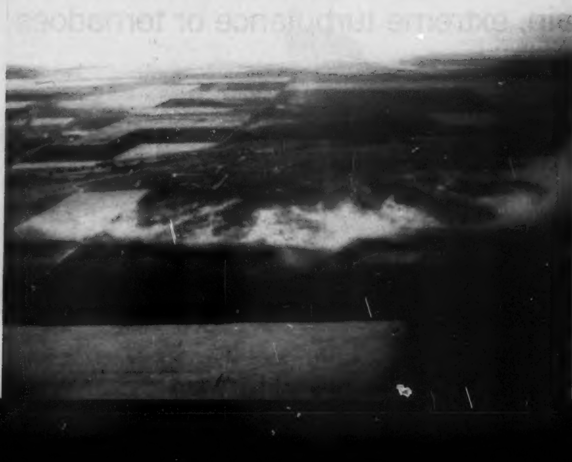
of further development while photo 7 shows the microburst outflow and vortex in the dissipating stage. The presence of diverging outflow and the vortex structure is a clear indication of a severe microburst.

7

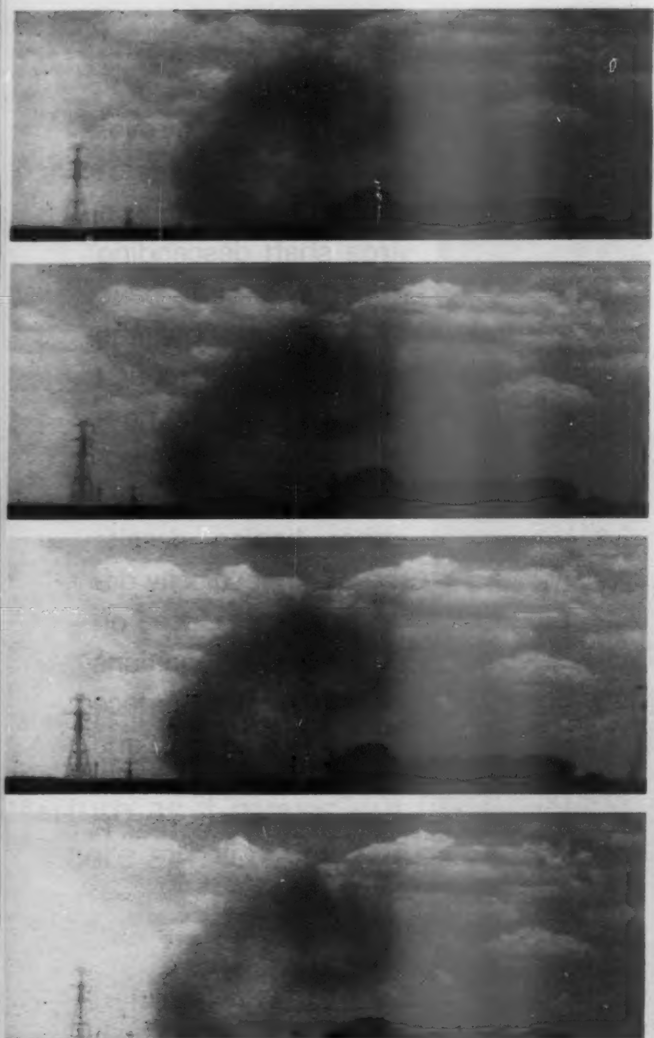


This sequence details the microburst outflow with the vortex structure as it moves out from the rain core at microburst center.

Occurring directly over an airport, the microburst at left is seen as a virga shaft descending from a cloud base 12,000 feet above the ground. This microburst happened in a non-thunderstorm convective cloud. It appeared rather benign despite the 65-knot velocity differential it produced on the runways. Conditions were dry at the surface with a temperature and dewpoint spread in excess of 30 degrees F.



The lower left photo shows the ring of dust associated with a dry-type microburst produced by a rainshaft that evaporated before reaching the gound. The ring of dust outlines the horizontal outflow of the microburst. The turbulence along the edge suggests a horizontal roll vortex structure. This view of localized blowing dust is a typical visual clue of the dry-type microburst.



The sequence at left details a horizontal roll vortex from a microburst. Presented in this manner for emphasis, the series shows the leading edge of the microburst outflow which, due to its intensity, rolls up into a vortex.

The photograph above shows a classic thunderstorm. While there are no indications of a microburst present, pilots are warned to stay clear of such thunderstorms because they may contain severe windshear, hail, heavy rain, extreme turbulence or tornadoes.

This view of blowing dust on runways depicts a direct hit by a microburst, a clear indicator of danger.

To Go or Not To Go

By Lt. Richard P. Hajek

WE were scheduled to provide AEW coverage for the battle group transit into port with a subsequent recovery at NAS Southwest Asia. The crew slowly assembled in the ready room, searching for coffee mugs and trying to become human before the 0400 brief. A disgustingly cheerful CVIC briefer gave us the current situation followed by an equally cheerful weather brief. The aircrew followed with their areas of cognizance, emphasizing the recovery on dry land and the somewhat nasty weather outside. We still had time for a quick breakfast up in the "dirty shirt" wardroom and a few more cups of coffee to wake us up.

The fun started when I walked out on the catwalk into rain, wind and darkness. It was no trouble getting down the deck to the "Hummer Hole." The problem was trying to stop from becoming a fixture on the side of the plane. "Why am I here," I wondered. "Why am I in carrier aviation?"

Preflight and start were normal, and I was beginning to feel sorry for the maintenance troops launching us when the yellow shirt signaled us to break chocks. We had briefed procedures for sliding aircraft and taxiing on the wet, slippery deck, and we made it to the cat without problems. A little bit of spray greeted us at the end of the cat shot, and we departed right into a cloud bank.

We were climbing through angels 10, still in the clouds, with some turbulence and generally nasty conditions. I wondered when we were going to break out. I apologized to the crew about the turbulence and explained that the stewardess would be around with drinks and snacks shortly. Still in the clouds at angels 18 (Hawkeyes aren't known for their rate of climb), we started to get some St. Elmo's fire across the windshield; then the St. Elmo's fire started coming across in green sheets starting at the nose of the aircraft.

Boom! A lightning strike! It was bright, loud and scary. Luckily the autopilot was engaged since I was temporarily blinded.

After regaining my vision, I took a quick look around the cockpit for any damage. Nothing was immediately evident, and we began a thorough check of all the systems while talking to the guys in back. The back end reported problems with HF No. 2 and possible loss of the trailing wire antenna. We tried to talk to the ship, but static made communication extremely difficult. We continued to climb in a futile attempt to find a clear area in the dark skies. There was no way to climb above since the Hawkeye is ceiling-limited.

We managed to keep out of further trouble by driving until St. Elmo's fire threatened to take over the cockpit, then reversing. We eventually managed to get through to the ship to advise against launching our assigned CAP. Daylight finally came, as it has a way of doing, and keeping clear of the bad weather was easier. The rest of the flight and recovery were uneventful.

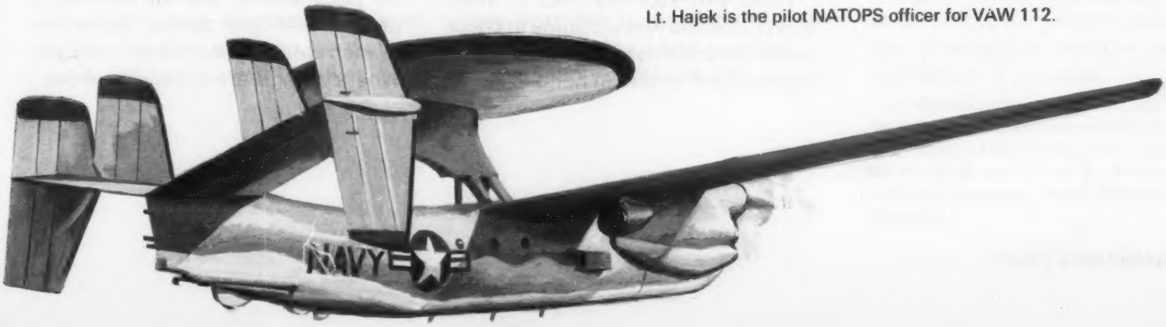
Later in the superb club facilities of NAS Southwest Asia, we talked about the morning's events. First we covered the obvious points, such as the use of thunderstorm lights in the cockpit at the first indication of serious St. Elmo's fire, and the questionable wisdom of having a quarter-mile lightning rod hanging from the back of our plane in adverse conditions (discovered on postflight as a crisp, burned hole where the trailing wire antenna used to be).

Then we started to question the reason we were even up there. Sure we were on the air plan and a scheduled event, but should we have gone? We definitely should have gotten closer to the weather briefer, maybe had a face-to-face with the guy and a tight look at the charts. This might have told us that the weather was not good for flying, not only for us but for anyone who might be out there looking for the battle group.

The pilot-in-command has the right **and the responsibility** for safety of flight and should have questioned the necessity for our launch. Sure the Hawkeye is an all-weather aircraft, but there are limits. Luckily there were no major problems on our flight, but what if something serious had happened? You know who would have gotten the blame — certainly not Strike planning.

Don't let the pressure of making a scheduled event influence your judgment about launching in hazardous conditions. Operational necessity is another matter, but this launch could definitely not be classified as such. You sign for it, you fly it, and you make the decision to go or not to go. ●

Lt. Hajek is the pilot NATOPS officer for VAW 112.



As I rolled onto final, I saw the bow bury itself in a wall of green water.

BAD DAY

By Lt. Steve Malloy

WE were four days from home at the end of a six-month deployment in the Indian Ocean. It was a standard IO cruise for a LAMPS det — lots of dawn and dusk patrols, a couple of stops in Diego Garcia, dust storms off Masirah and delouse ops on short notice. The guys were ready to go home. We were 14 days beyond our last liberty port. The transit and the cruise were almost over, and the restlessness that had settled in was at a new peak.

The weather on the transit had been miserable: Numerous flights had been cancelled due to sea state and PIM considerations. In the LAMPS community, feast or famine is the governing principle for flight ops. If the bird goes down or the weather gets rotten, no one flies. (Well, no one should fly.)

The pilots were anxious to fly, having had several flights cancelled due to weather, but the maintenance crew wanted to put last-minute touches on the aircraft for post-cruise inspection. No one was getting enough rest; good sleep was hard to come by in 12-foot seas. The quality of food had reached an all-time low as the ship emptied its reefers. In general, no one was enjoying the trip home. The lack of concentration, tension and get-home-itis were discussed at a safety stand-down earlier in the transit.

I had extended my PRD to make this cruise and was planning to check out of the squadron immediately upon return. With orders in hand to PEP in the UK, I was constantly thinking of things that had to be done upon returning home. This lack of concentration followed me into flight. I even made a note on my kneeboard during a flight to order a passport!

The previous day's flights were cancelled by the CO, although the conditions were not all that bad. Another H-2 in the group had flown. Yesterday's rationale (rightly so) was "We're not out here to keep up with the Jones'." But today, for some reason, I was obsessed with getting the X. I knew the conditions were about the same as yesterday, but I convinced myself to fly. And no one tried to stop me. The CO and officer-in-charge hadn't put the CNX on me yet, and I was scheming to get in the air. As usual on a rough day, the hardest part of the whole evolution is getting the bird out on deck. As I stood on the bridge waiting for a green deck to move the aircraft, I wondered, "Why hasn't anyone stopped me?" Here I was questioning why no one had stopped me, yet I didn't stop myself.

The deck parameters were fair, not great, and the aircraft was spotted on deck. Looking back at it, they were the worst pitch and roll parameters I had accepted all cruise; but at the time, I accepted them. I had let my guard down. The ship came back to PIM, and the aircraft got soaked. The maintenance crew unfolded the head, water-washed the engines and launched the aircraft without a hitch.

Ahh, back in the air. Ops normal, three souls, two plus three zero. I was pleased to get off the ship. I had proved to myself, at this point, that everything was OK; I got the bird out on deck and in the air without a problem. All my doubts about the launch were erased. I was in the air, where things are simpler, where I

. . . I spent what seemed like forever over the deck, waiting for the deck to stabilize again. Trying to stay level and not follow the deck was difficult. . .

was in control.

I was confident when I left, that had there been an emergency of any type, I could get aboard without a hitch. The deck parameters were satisfactory. What I didn't count on, or *what I somehow chose to ignore,* was that conditions could deteriorate. And, in fact, they did, severely. About 1+30 into the hop, Freddie, our controller, called to verify a time for flight quarters. I had already decided that the night event was cancelled.

Freddie informed me that the ship had gone to heavy weather condition 1 — no personnel topside without the OOD's permission — buddy system in effect. In fact, they had gone to heavy weather condition 1 some time ago. My grip on the seat cushion got tighter. He wanted to know if I was interested in moving flight quarters up. How bad would it be when I got to homeplate? I got back in time to see the ship adjusting course to BRC.

What had been a reasonable landing site when I left was no longer a suitable site for standing, let alone landing a helicopter. The ship adjusted course and speed several times to get the best deck available, but the best conditions were still poor. Tower called, "Pitch 4, roll 10. Winds 10 to starboard at 44 knots."

As I rolled onto long final, I saw the bow bury itself in a wall of green water. If that was a pitch 4, I'm Albert Einstein. Pitch 4, roll 10 — the maximum allowed in both directions. Wind 44 knots is more than allowed. What am I going to do, *not land*? As the aircraft approached the deck on short final, the ship stabilized from three violent pitches. The deck was relatively smooth, but I knew more was on the way. As I crossed the deck edge, the ship rolled so far that the LSE almost fell over. His eyes were so big I could see them through his goggles 40 feet away. On one roll I could see the waterline below me, all covered in algae, as I hovered over the deck.

I spent what seemed like forever over the deck, waiting for the deck to stabilize again. Trying to stay level and not follow the deck was difficult. I looked at the MAC (mast/stack) and the horizon and waited till it was relatively smooth, then landed.

It seemed like it took forever to get chains on. We didn't take any large rolls on deck. Finally, tied down and shut down, I unstrapped. It took a little prying to free the seat cushion, but I got out of the aircraft and entered the hangar, to meet 20 ashen faces with the same expression.

Now to add insult to injury. The bird was taking a pounding on the deck, enough so that leaving it out on deck was ruled out as a option. If a wave broke over the flight deck, emergency reclamation would have to be done. The fire party was mustered for extra help. Progressive chains procedure would be used to move the aircraft. This kept several chains attached to the helo at all times and made for a very slow move, since the aircraft only moved one chain length at a time. After three successful short moves, the nose of the aircraft was almost in the hangar, the main mounts now between the tracks of the hangar.

At the end of the fourth move, just as the tail chains were being applied, the ship took a huge roll to starboard, and the tail slid 15 feet toward the edge of the deck. I couldn't believe what I was seeing. As quickly as the ship rolled right, it righted itself, and the tail stopped. It certainly didn't stop from any human effort. It was pure luck. The tail was chained and the situation assessed. The aircraft didn't hit anything, there was no damage, and no one was hurt. But the aircraft could not have been left where it was; it had to be moved again. It couldn't be safely secured to the deck in the position it was in. The tail was brought back to the center of the deck, then the move was completed.

Our collective desire to get the X put us in extremis. We all learned some important lessons, some of which we already knew but didn't apply properly in this situation. When doubt creeps in, stop and ask yourself what you're doing, and why. Had I called time out and taken a look at things, maybe I would have stopped the evolution before it happened.

Pushing the envelope is one thing; ignoring common sense is something else. I got myself into a position that I almost could not get out of.

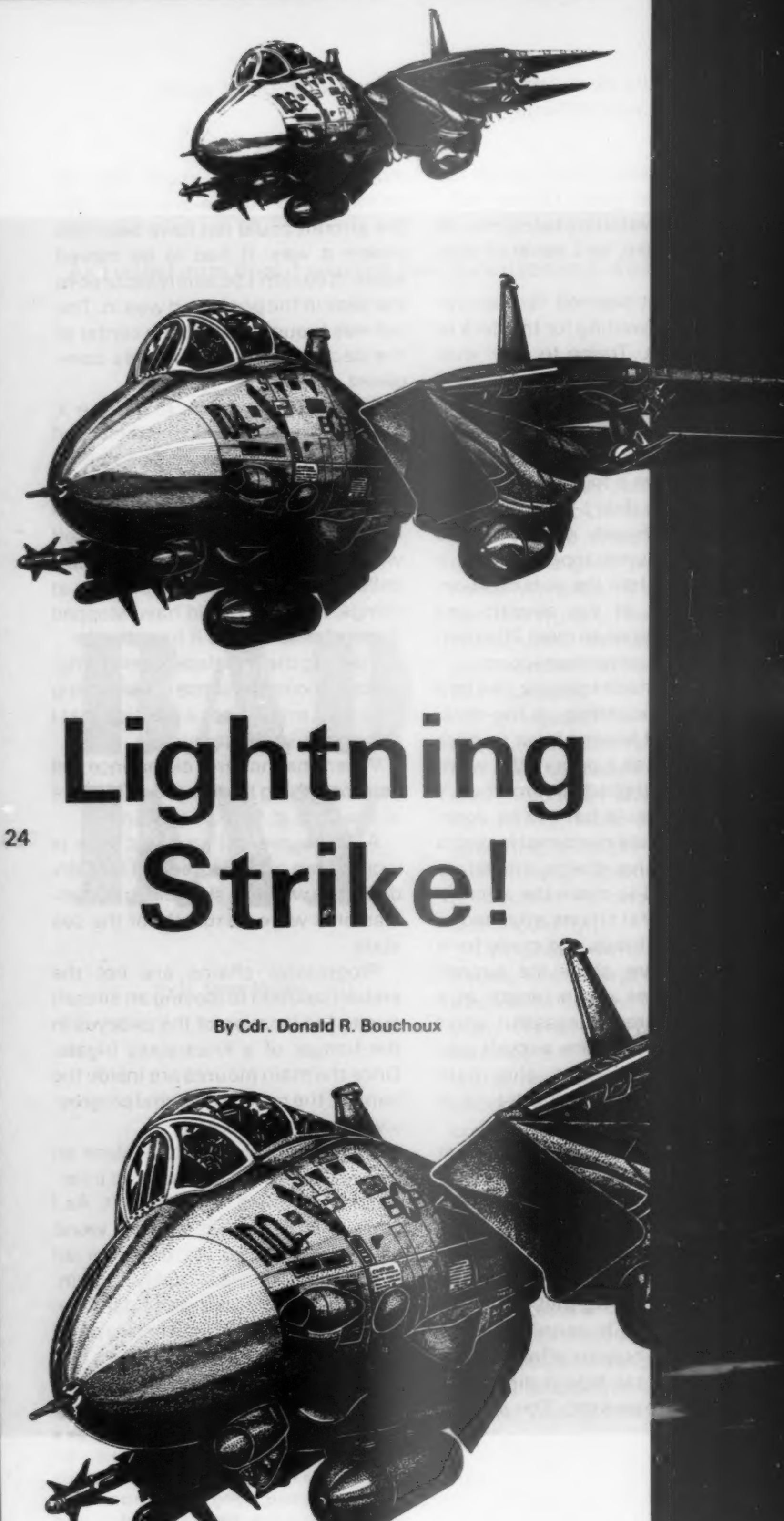
When instinct and experience tell you something is wrong, don't ignore it. Evaluate it, then decide on it.

A 10-degree roll on a wet deck is worse than a 10-degree roll on a dry deck. The wet non-skid and the treadless tires were no match for the sea state.

Progressive chains are not the end-all solution to moving an aircraft due to the location of the padeyes in the hangar of a Knox-class frigate. Once the main mounts are inside the hangar, the principle behind progressive chains is defeated.

These Delta Sierras took place on the day before we crossed the international dateline, headed east. As I mentioned before, it was my worst day yet. However, the day after all this happened was "today" again. Since the ship crossed the dateline, the calendar was turned back a day. I had a rare opportunity to relive a bad day to correct it. And this time, the bird stayed in the barn. ●

Lt. Malloy completed his first sea tour as a detachment maintenance officer in HSL 37, NAS Barbers Point, Hawaii. He is currently on an exchange tour, flying the Westland Lynx, with 815 Squadron, RNAS Portland, Dorsett, England.



Lightning Strike!

By Cdr. Donald R. Bouchoux

. . . My pilot then told me that he was flash-blinded and couldn't see his instruments . . .

IT was a stormy night in Southern California. In preparation for a WESTPAC deployment, my squadron was charged with flying five Tomcats to the CV on the night's last CQ event so that they could be stuffed in the hangar during the midwatch respot. The rest of our aircraft would be flown aboard the next day. I placed great emphasis on the importance of accomplishing this mission, as any delay would complicate the CV's deck spot.

Takeoff was scheduled for 2300 local with a 0015 recovery expected. At 2000 local, thunderstorm condition II was set at NAS. Although the field had intermittent cells pass, the weather at the field was approximately 2,000 broken with five to seven miles visibility. After much discussion among the flight leads and mission commanders, I decided that the weather was sufficient to proceed. Four of our five aircraft manned and launched on time and proceeded uneventfully to the CV. The fifth was mine. My operations officer and I went through a series of black box changes before finally taxiing at 2315. By now a squall line had moved across the departure radial at 7 to 10 nm from the field. At about 2320 tower reported that an F-14 had been struck by lightning and was returning to the air station.

We decided to wait at the hold short until conditions improved. At 2335 with the weather marginally better, we decided that we should launch to meet the overhead time. I planned to employ the radar to avoid any imbedded cells and to get VFR as soon as possible on departure. Tower cleared us for takeoff with a normal climb to 2,000 feet. As we went feet wet, departure cleared us to 14,000. At 2,200 feet we went IMC. Scanning the radar, we made minor course adjustments to avoid what appeared to be a cell. At 5,000 feet St. Elmo's fire appeared on the radome.

At 7,000 feet there was a blinding flash and an incredible thump, and I knew we had been hit by lightning. Incredible! It could never happen to me — I knew enough to prevent this from happening. Our trusty Tomcat was still flying fine. However, a disconcerted voice came from the front cockpit. It was my pilot asking, "Are we still climbing?"

I still had all my attitude references and answered in the affirmative but then asked, "Why do you ask?" My pilot told me he was flash-blinded and couldn't see his instruments! One very tense minute then transpired while I gave him directions to level off while declaring an emergency with departure control. Fortunately, we soon exited the squall line and regained VMC conditions. After about a minute, my pilot gradually became able to see the VDI, his primary attitude reference. Assessing the effect on the aircraft, I found the air-to-air radar and INS were the only casualties, neither of which would prevent a safe return.

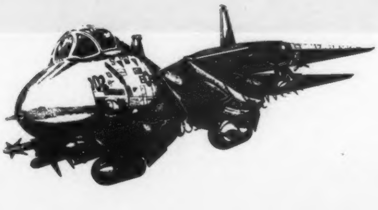
Remaining VFR in a holding circle, we had to decide what to do. After some discussion, it was apparent that my pilot's vision was slowly returning, with the exception of a blind spot to his right where, presumably, the lightning strike had most affected his vision. Looking back in the direction of the air station, the squall line was still an obstacle. Returning to the NAS might prove as harrowing an experience as our departure. Towards the CV, the weather was much better. After some agonizing, we decided that my pilot's vision was sufficient for a CV recovery. Informing the ship of our predicament and desire to recover, we were vectored for an immediate straight-in CV-1 approach that resulted in a flawless OK-3 pass.

In retrospect, I had put myself, my pilot and my aircraft through some unnecessary thrills. The operational commitment was important, but there were ways to contact the CV to inform them of the reason for a delay, even if we had to delay until the next day.

More knowledge of lightning strikes would have helped. For example, asking departure control for a deviation from the SID would have enabled us to remain VFR below the squall line, reducing the chance of a strike. Operation of the air-to-air radar may actually increase the chance of a lightning strike.

Subsequent discussion with a meteorologist indicated that the buildup of St. Elmo's fire was a warning of what was about to occur. I also discovered that the most likely altitude for a lightning strike is the freezing level. Chances of a strike can be diminished by avoiding this altitude by 3,000 feet. In short, I learned that I didn't know everything about operating in weather.

Cdr. Bouchoux is commanding officer of the VF 1 Wolfpack, based at NAS Miramar, Calif., and deployed in USS *Ranger* (CV 61).



Weather Mins and the Carrier Pilot

By Lt. Mike Manazir

HOW many of you have ever filed to a destination with weather less than 200½ or commenced an approach intending to land with weather at 100¼ and forecast to remain the same? Ever go to zero-zero? The answers to these questions should be the same: No way, it can't be done. *They won't let you!* The control towers, approach controls and the centers who guard and guide us while we fly won't allow us to do any of these insane things. Anyway, who would want to?

OPNAV 3710.7 is very specific about required weather minimums at our departure field, destination and alternate. All of us are familiar with the chart of minimums to

be used in filing for an alternate. You know that when the destination weather is forecast to be zero-zero, the alternate weather must be 3,000-3. If it's above mins but below 3,000-3, then the alternate must be at non-precision minimums plus 300-1, and so on. Break these rules and have a mishap due to weather, and you'd have your wings ripped off your chest — if you live.

Shipboard operations are not governed by the same rules. CV approach weather minimums are spelled out in CV NATOPS. They may be strictly followed in a CQ environment, but can rapidly fade into obscurity during deployed blue water ops. In this case, the ship conducts flight ops with no divert available and uses tankers for air wing fuel requirements.

How many pilots out there had their seat cushion surgically removed after *getting aboard* when the weather was 100¼ at night? Who's called clara at three-fourths of a mile and not even had the ship in sight, let alone the landing area? How many Paddles out there have said, with an airplane at one-half mile, "I've got ya, keep it coming."

Bravo! Now what does that tell you — that you guys can *hack it*? We're all carrier pilots. We're proud of getting aboard the first pass, no matter what the conditions. There is no divert, and there's only enough gas airborne to give us another couple of passes in case we miss this one. When the ship works blue water ops, weather becomes insignificant. We do whatever it takes.

The professional carrier pilot will complete the mission in any weather. It is the battle group commander's decision to launch and recover in extreme weather, but it is solely the pilot who gets it back aboard. This is not a favorable scenario. Pilot-in-command prerogative is often overwhelmed by operational pressure to complete the mission.

There are two words that should cause heart palpitations in the most stalwart of safety officers: **operational necessity.** OPNAV 3710.7 and NATOPS publications use this umbrella to cover a number of unforeseen circumstances and rule exceptions. They create an avenue through which operational commanders can *bend the rules*— the rules by which we pilots train to fly (and live) around the ship. Does anyone question the pilot's ability? Does anyone ask his opinion? Would he refuse to go flying given the choice? Hardly. He can hack it and will go on hacking it until he exceeds his own limitations. Mishap cause: pilot error.

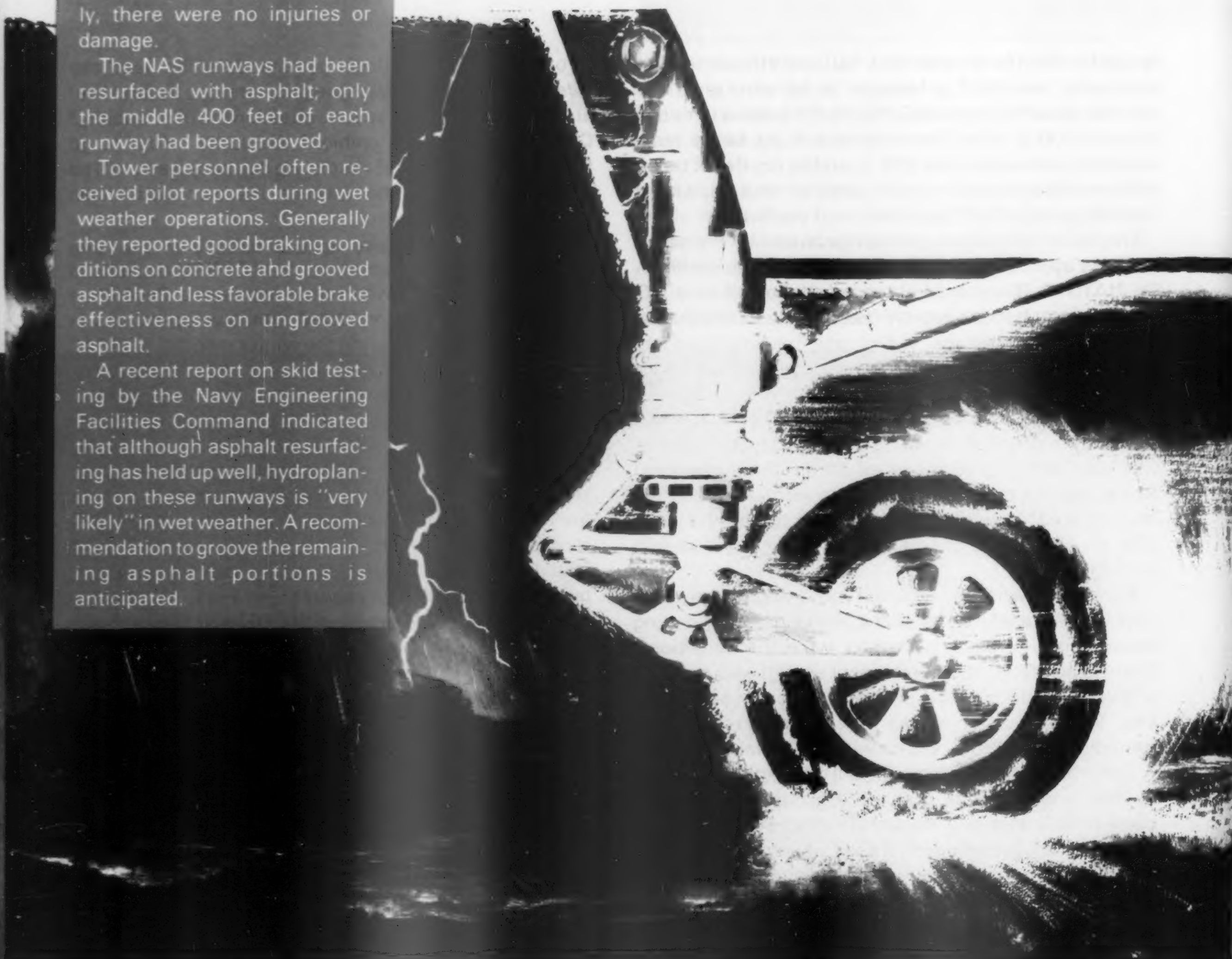
Operational necessity applies directly to the ship working blue water operations, and OPNAV neglects to provide any guidance whatsoever in this area. Recently, a carrier battle group conducted extensive operations in the Northern Pacific during the winter months. NORPAC weather is infamous for both unpredictability and ferocity. **Operational necessity** required that the carrier conduct operations both day and night in all weather to test the limits of flight operations in that part of the world. Extremely low ceilings and visibility, coupled with high winds and a pitching deck, were daily events. There was the constant threat of airframe and engine icing. Entire recoveries commenced in near zero-zero weather. The ship launched numerous times in weather that was below minimums and *forecast to get worse* — all under the guise of **operational necessity.** Diverts? They reported the same weather as the carrier.

Where do we draw the line? Should OPNAV give battle group commanders this much latitude? If the situation continues, how do pilots *train* for such weather conditions? The air wing embarked during the NORPAC operations was just completing a full cruise and was "up on the step" in carrier operations, as was the flight deck. How about an air wing starting work-ups with a "green" deck?

Currently, the answer lies at the embarked command level in their ability to weigh the consequences of operational necessity in extreme weather. This level of decision-making may not be appropriate. Should OPNAV provide more guidance and establish weather criteria for launch while a carrier is conducting blue water operations?

I don't have the answers. I'm a carrier pilot and I can hack it. But, should they let me? ●

Lt. Manazir is an instructor pilot/LSO with VF 124, the F-14 FRS in San Diego. He completed two WestPac cruises with the Screaming Eagles of VF 51 and has logged over 1,000 F-14 hours and 300 career traps.



In the Groove

A T-2B was landing in wet weather. On touchdown the trainer experienced hydroplaning and blew a tire. A few months earlier a C-12 hydroplaned and went off the runway. Fortunately, there were no injuries or damage.

The NAS runways had been resurfaced with asphalt; only the middle 400 feet of each runway had been grooved.

Tower personnel often received pilot reports during wet weather operations. Generally they reported good braking conditions on concrete and grooved asphalt and less favorable brake effectiveness on ungrooved asphalt.

A recent report on skid testing by the Navy Engineering Facilities Command indicated that although asphalt resurfacing has held up well, hydroplaning on these runways is "very likely" in wet weather. A recommendation to groove the remaining asphalt portions is anticipated.

HYDROPLANING

By Cdr. Joseph F. Towers

Graphics By Frank L. Smith

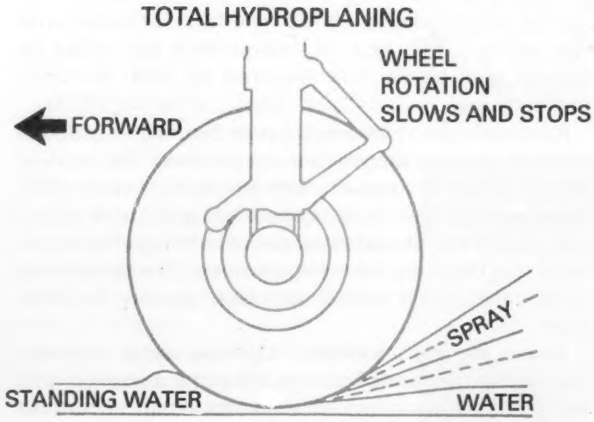


Figure 1

HYDROPLANING occurs when contaminants on a runway surface disrupt the contact between the tire footprint and the pavement, making it hard or even impossible to steer and brake (figure 1).

Dynamic hydroplaning occurs when the standing fluid is not displaced from under the tire at a fast enough rate to allow the tire to make contact over its entire footprint area. This type of hydroplaning may be either partial (a portion of the tire is still in contact with the pavement) or total (the tire is completely detached from the surface). The aircraft is either partially or totally supported by the fluid pressure between the tire and the pavement.

Hydroplaning can result in the complete loss of tire friction, steering and braking.

During total dynamic hydroplaning, wheel rotation can stop completely. Research has determined that minimum total hydroplaning speed in knots to be equal to nine times the square root of the tire pressure:

$$V = 9\sqrt{\text{tire pressure}}$$

where V is the minimum total dynamic hydroplaning speed in knots and the tire pressure is in psi.

This equation holds true for a rotating tire as it travels from a dry to a flooded runway section (figure 2). Later investigations indicated that when an aircraft touches down on a flooded surface, the hydroplaning speed for a nonrotating tire was slower than the original NASA equation for a rolling tire.

Consequently, the derived equation for a nonrotating tire is:

$$V = 7.7\sqrt{\text{tire pressure}}$$

Both equations serve as an excellent approximation of the minimum ground velocity for an aircraft to hydroplane. If a runway surface is rough, grooved or textured,

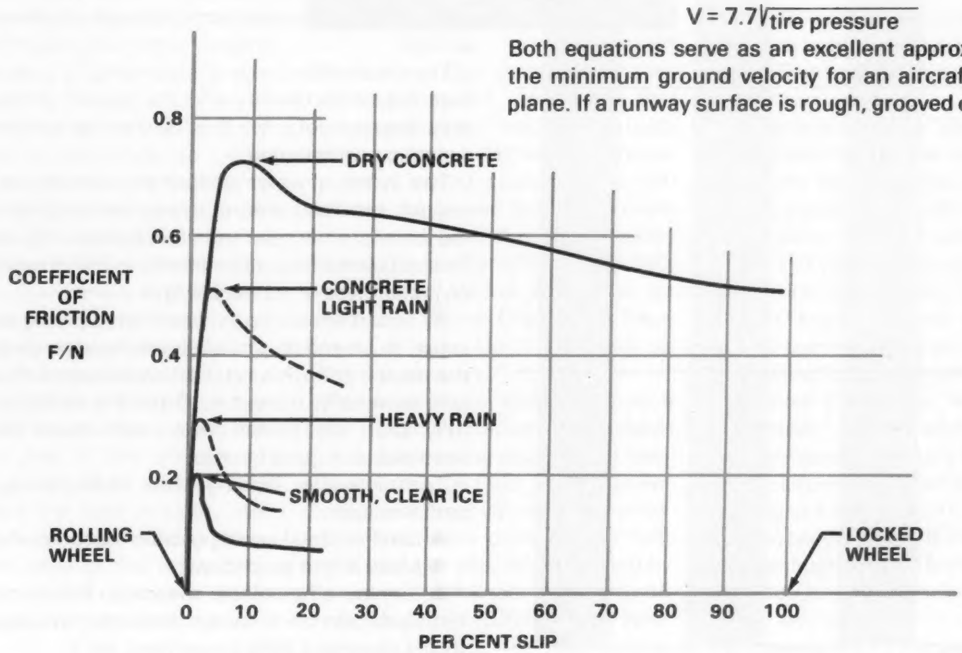


Figure 2 illustrates the coefficient of friction for an aircraft tire under various runway surface conditions. The degradation in braking ability for other than a dry runway can present a serious problem.

Figure 2

How water (and slush) increase takeoff distance

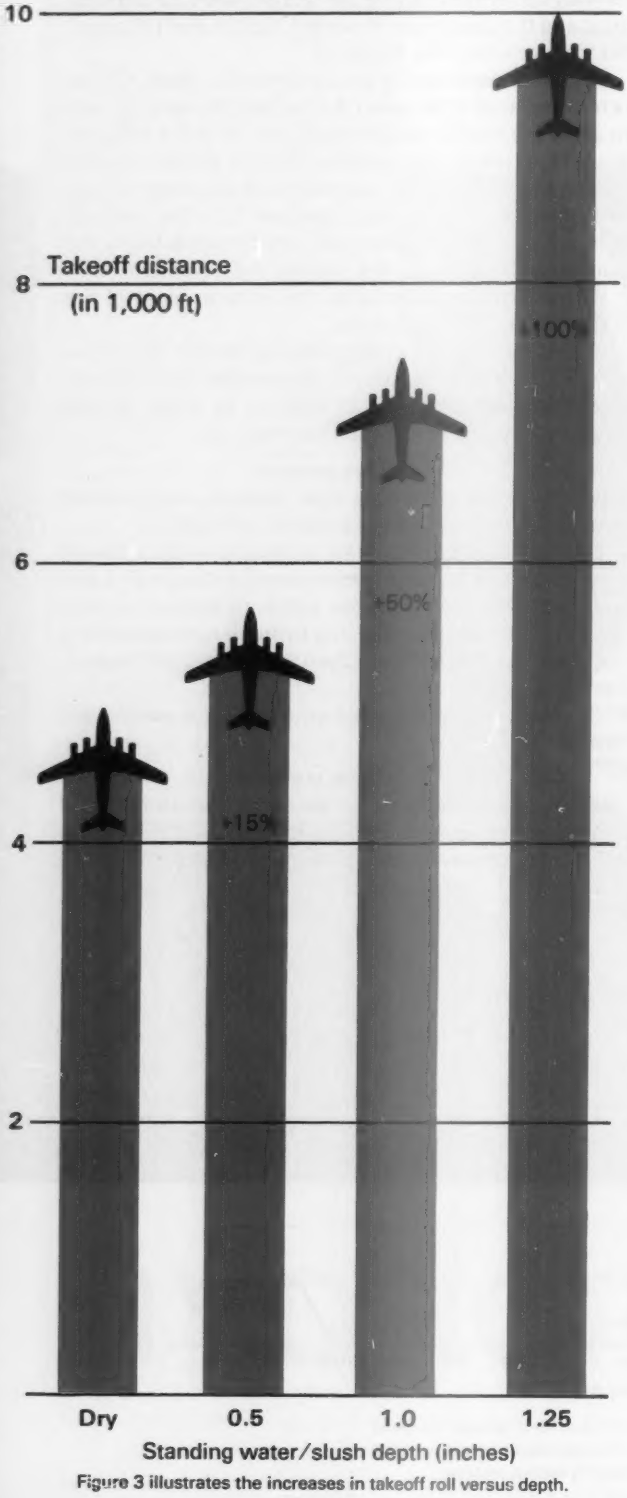


Figure 3 illustrates the increases in takeoff roll versus depth.
Figure 3

and the tires have good tread depth, then the fluid depth must exceed both the tread and runway groove depth for hydroplaning to occur.

During slow speeds, the aircraft tire mass is sufficient to displace the fluid beneath it. At higher speeds the fluid cannot escape, and the tire is lifted off the surface and is supported by a thin layer of fluid.

Viscous hydroplaning is a term used to describe the normal slipperiness or lubricating effect that occurs on a wet surface. This type of hydroplaning can occur at speeds well below that required for total dynamic hydroplaning.

Reverted rubber hydroplaning can occur when a locked tire skids across a slippery wet or icy surface. The result is the generation of some very high temperatures (up to 600 degrees Fahrenheit/315 degrees Centigrade) due to friction. Steam is produced that serves as a lifting medium on which the tire rides above the pavement. The steam heat reverts the rubber back to its black, gummy, uncured state.

Before starting a takeoff in standing water, consider the resultant extended ground roll and the possibility of damage due to spraying contaminants. When the runway is contaminated by water (slush or wet snow) in excess of one-half inch, the takeoff should not be commenced. At takeoff speeds, the viscosity and resistance of the contaminants increase dramatically. The resultant wheel drag considerably increases the takeoff roll (figure 3).

Slush drag is a term which refers to water (or partially melted snow) that retards the forward acceleration of an aircraft.

The retardation force of slush drag is proportional to fluid depth, its density and the square of the forward groundspeed velocity. This is true up to the onset of dynamic hydroplaning.

Two inches of water or slush on a runway can produce enough resultant drag to overpower engine thrust and reduce aircraft acceleration rate to zero. This means that most jet aircraft would be unable to reach rotation speed (V_r) regardless of runway length.

By now it should be evident that standing water, (wet snow, slush and dry snow) slows the acceleration during the takeoff roll. This retardation becomes more noticeable as velocity increases. Often the ability to successfully abort the takeoff when well down the runway becomes very questionable.

Techniques for landing when hydroplaning is anticipated include:

- Land at the slowest possible touchdown speed.
- Make a firm touchdown.
- Employ all available means to safely and expeditiously decelerate the aircraft (spoilers, anti-skid braking, thrust reversers, field arrestment, etc.).
- When anti-skid is inoperative or not available, judiciously apply brakes. Exercise caution to avoid locking tires, which could result in a blowout as the aircraft crosses over a dry runway section.

A Picture's Worth 10,000 Words

By Lt. Ray Greenlee

. . .We watched in amazement as a huge dust cloud formed underneath this rapidly moving storm cell. It literally attacked the field, and the tower disappeared from our view. . .

AFTER the Delta Airlines accident in Dallas in 1986, our squadron talked quite a bit about microbursts and wind shear. "OK, avoid them," was pretty much the consensus. Even with the "vast" meterological background my sociology major gave me, I could understand that, but sometimes a picture's worth. . .

It was a typical northern California day, overcast morning, beautiful afternoon. The flight schedule had me down for a bounce hop, and as a squadron instructor pilot, that doesn't happen too often. So I was in a good mood, knowing I could enjoy the flight without "instructing." We would start out with some ILS approaches into Vandenberg and then over to Palmdale for some pattern work.

Piece of cake.

The flight started out well, and my copilot was a good stick, so I was enjoying the ride as we crossed the Tehachapi Mountains into the Antelope Valley. The Antelope Valley is home to Edwards AFB and Lockheed's Production Test Facility at Palmdale, our destination. One big, dusty, continuous string of dried lake beds.

The weather guessers had predicted a 4,000 foot broken ceiling with thunderstorm activity along the mountains and in the vicinity of Palmdale. At 30 DME and 10,000 feet, we had the field in sight, and only one dark cumulous buildup along the eastern edge of the valley. We shot the full VOR approach to a touch-and-go and lifted off runway

Lt. Bob Broadston

25 to enter a right downwind. As we turned crosswind, we noticed that our single-storm cell was quickly moving inbound. At the 180, my copilot and I looked at each other and decided maybe we ought to extend and let this blow through. "Tower, Romeo Charlie Zero Four, right 180, we'd like to extend downwind for weather." "Romeo Charlie Zero Four, Roger, it looks like it's kicking up quite a dust storm."

We watched in amazement as a huge dust cloud formed underneath this rapidly moving storm cell. It literally attacked the field, and the tower disappeared from our view. The wind, which had been calm on our first touch-and-go, was now reported by the tower at 38 knots gusting to 45 knots, and the visibility was zero. Tower also reported a 180-degree shift in wind direction.

Then we saw "it." Amid a couple of flashes of lightning, a downdraft became distinctly visibile in the dust cloud. The dust acted as a dye and showed the contrast between the downdraft and the rest of the storm. A plume of dust hit the earth and created huge rolling waves of sand, dirt and debris. The storm cell stalled and hovered over the field. (See photo on page 19).

We had seen enough! We put our clearance on request with departure. We were cleared to proceed directly to Palmdale, the very place we were now quite anxious to leave! We debated the controllers sanity, politely refused and circled the field to the north. The uneventful trip home was more than welcome.

A severe weather warning was broadcast shortly after our reports to Edwards. We could only imagine the damage that cell would have done to an airplane, although visions of Delta Flight 191 come pretty close. What if this storm had rolled through after sunset? I doubt anyone would have seen it coming. Attempting a landing in it would have been suicide.

So now I have my "microburst/windshear" picture tucked away in my permanent memory bank. It's a good picture and one I'll always be looking to avoid. If you're like me and need to see it to learn it, I hope you're lucky enough to see it from a distance like I did. Otherwise, the picture might be the last word.

Lt. Greenlee is a P-3 pilot with VP 46, NAS Moffett Field, Calif.

. . . Out of nowhere, I heard loud cracks all around me and realized we were being hit by hailstones. . .

Get-Home-Itis

By Lt. John Sheehan

WHEN I was a young, wild student aviator in the training command, I experienced my first case of get-home-itis. It was my first cross-country in a TA-4J Skyhawk. The hop was to be flown from Pensacola, Fla., to my hometown, which was also my instructor's. The instructor was very familiar with the route and the destination airfield since he took advantage of the squadron's cross-country policy every weekend to fly there.

During preflight planning, he filled me in on various aspects of the flight from memory. I trusted his every suggestion; after all, he was an experienced pilot and was also the instructor.

The weather in Pensacola was clear; however, the forecast showed a line of severe thunderstorms 100 miles to the northeast. It seemed to me that without an on-board radar, we would never be able to stay clear of thunderstorms. The instructor convinced me he had experience in picking his way through. After all, it was a daytime hop as required by the syllabus, and we could sight and stay well clear of any serious buildups.

Preflight and man-up were conducted rapidly, and it appeared we would take off ahead of schedule to arrive at our destination before dark. On start-up we developed a major problem that would prevent our taking that jet. Since my instructor was a senior member of the command, we were able to acquire a new training aid, but not as quickly as we hoped. We manned up after merely kicking the tires, and off we taxied.

At the hold short while getting clearance, we noticed that the main gyro had precessed about 20 degrees. I was assured that everything would be OK since it seemed stable. It just wouldn't sync up. It seemed odd to take such a plane, but I figured he was the instructor, so what the heck.

Our real problems began 100 miles north when we experienced our first thunderstorm. At first they were easy to pick out, but after about 20 minutes, the weather closed in and we went IMC. This was the first time I started to feel very uneasy about the hop. Turbulence was slowly building up, and before long, we were thrashed about like a cork in a wild rapids. My instructor wasn't talking very much at this point, even after I made a few

. . . Static in the headset was so bad our comms were completely lost. My instructor finally decided to turn back and head for home. I breathed a sigh of relief. But the fun wasn't over yet. . .

inquiries. I figured he had his hands full. Out of nowhere, I heard loud cracks all around me and realized we were being hit by hailstones. I also noticed we weren't holding heading or altitude very well. It occurred to me that we were limited to the standby gyro since we were IMC and the main gyro was precessed.

We attempted to call Center to see if they could vector us around the weather. Static *in the headset was so bad* our comms were completely lost. My instructor finally decided to turn back and head for home. I breathed a sigh of relief. But the fun wasn't over yet. In the turn, we managed to lose our generator and had to pop the emergency generator. We finally did hit VMC condition and thought we were clear from danger; then we were hit by a wall of hail the size of golf balls. The impacts were so incredibly forceful that we had severe damage done to the leading edge slats and nose cone. We arrived at Pensacola shaken up and damaged, and a lot smarter.

Now a seasoned aviator, I see how careless and non-professional my instructor was that day. I also see how inexperienced and foolish I was at the time. Although we had talked of get-home-itis at safety stand-downs, I really didn't think I would ever fall prey to it. ●

Lt. Sheehan flies with VF 24, based at NAS Miramar, Calif.

Angle of Attack vs. Airspeed

. . . The turbulence increased even more, and to my horror, I watched the airspeed gauge pass 90 knots. . .

By Lt. C.S. Hosier

DURING the post-cruise turnaround cycle, in an effort to use the precious hours allotted by the OPTAR god and get some quality night instrument time, my trusty COTAC and I had planned an instrument round robin that would take about six hours. Our route of flight would take us north up the coast to avoid some nasty weather that was slightly inland. From that point we would head east for a practice approach at Ski Resort AFB to a touch-and-go. Our final leg would bring us back down to the southwest for more of the same at Casino AFB and finally back to homeplate to see a spectacular sunrise over the Sierra Nevada mountains.

We filed, briefed, grabbed a quick slider, manned up and launched about 0300. The winds and the inland weather were exactly as briefed. That warm fuzzy feeling was beginning to settle in; I knew I was in for a pleasant, relaxing six hours of easy night instrument time.

About 30 minutes outside of Ski Resort AFB, we contacted metro only to find out that the briefed weather for the airfield and surrounding area was going to be a little worse than we thought. It really didn't matter because, as we all know, the weather doesn't make any difference as long as your practice approach is not at your intended point of landing. Commencing at FL 200, our aircraft was in the midst of some fairly moderate snow showers. The more we descended, the harder the snow began to fall. Since I was a cruise-experienced guy, I was undaunted by all of this weather; I dirtied the aircraft up and called for the landing checklist. Upon completion of the checklist, everything was going smoothly . . . so I thought.

Looking out for that familiar orange of the "on speed" donut in the AOA indexers, I noticed it was taking longer than normal to get there. The AOA gauge was showing 12 units, and the indexer had a corresponding red chevron on the glare shield. The turbulence began to increase as we passed the final approach fix, and the lights of the airfield were barely becoming visible through the snow. The turbulence increased even more, and to my horror, I watched the airspeed gauge pass 90 knots. Then there was no turbulence.

I was in severe stall buffet with my angle of attack gauge frozen solid at 12 units. I immediately applied stall recovery procedures, but could not reference my primary recovery instrument as it was frozen. After descending well below the MDA, I powered the aircraft out of the stall and executed a missed approach. My heart rate finally began to lower as we climbed above the weather into the clear on our way home.

I tried to justify why my scan failed to include the airspeed gauge when approaching an "on speed" condition. Perhaps a strange airfield at 0430 in the morning in less than desirable weather was my excuse. There was no excuse. I can't even begin to recall how many hundreds of times I have preached to my pilots prior to FCLPs or CQ to deliberately check their airspeed and angle of attack. I was guilty of having a different set of standards for myself than for other people. Every time the gear goes down, the airspeed must be checked against the AOA. Your life may depend on it. Mine and my crew member's almost did. We were lucky; we got to see that spectacular sunrise. ●

Lt. Hosier is the senior LSO in VS 33 flying the S-3A Viking.

. . . The fog gets worse than pea soup in a milk bowl at times, and when the ship finds a hole, you have to be there . . .

Aviate, Navigate — Coordinate

By Lt. Bauermeister

"NINETY-NINE Hoovers in marshal, this is Paddles. We're in and out of this stuff, and the ceiling is way down there. Check your landing lights on, externals bright and steady and watch your fuel." "Does 'watch your fuel' mean this could take a while?" I wondered. "We'll see you before you see us, left-seater fly the numbers, right-seater back him up and look for

the ship. You should see the wake at a half-mile, so put it under your left wing and be real smooth with the jet. Just say ball when you get it and listen for lineup calls. The deck is really wet — you probably won't see the centerline."

Wow, that was a mouthful even for a talkative LSO! It didn't exactly give me a warm and fuzzy feeling, like when you find out you really do have a 100-knot tail wind on a cross-country. What I felt was more of a cold and sweaty feeling. I had two, maybe three shots at the deck and then a long-range bingo to Eskimo AFB or Polar Bear Island Coast Guard Station. The Northern Pacific can get nasty and stay nasty, and you can bet the pressure to fly will be there. If we continue to operate carrier battle groups in NORPAC, our flight crews will have to be sharper than usual.

The Viking is a great platform for performing safely in a situation like the one just described, probably the best. Nevertheless, complications can quickly arise. The weather we recently experienced in the Gulf of Alaska forced pilots to fly strictly on the needles down to a half-mile or less, then come outside for a quick look and try to see something useful. The fog gets worse than pea soup in a milk bowl at times, and when the ship finds a hole, you have to be there.

It's very hard to stay inside and smoothly carry on with the approach when the ship isn't quite visible, yet the LSO sees you. That's where crew coordination has to be at its best. What kind of calls should the copilot make and when should he make them? Does this pilot like VSI calls, heading calls, power calls or no calls? What happens when you as copilot see the wake and maybe the shadowy outline of the stern but no landing area and no ball yet? Especially when two seconds earlier the LSO just said, "Paddles contact." Then what is the best way to help orient the pilot to the landing area and not hinder him?

I've found in this type of weather, there are three big things a copilot can do to help the situation. First, the pilot's mind is extremely busy during the approach; you can't afford to further clutter it. All transmissions must be short, contain just the information he needs to hear and be easily understood.

Second, in a low visibility situation like this, *your* eyes are going to be the first things in the airplane to see the ship. You have to determine when the information you see outside is more useful than what he sees inside. That grey hulk might be the ship, but it isn't going to mean a thing until the ball and the centerline are clearly visible; you have to know when to tell the pilot "good ball."

Third, you have to know when to call uncle and tell the world you're going around. It's easy for a pilot to get locked in on the gauges and trust that the CCA controller, the LSO and the copilot are going to make things happen. When you're at minimums and the fuel gauge is banging on the bottom, are the big guys going to want you to get aboard? You bet!

Don't let the pressure to recover on the ship override a safe landing. If it can't be done, let them know and bingo to your divert field. There's always tomorrow or the next day unless you get foolish! The last thing you need to do is consider all three variables as you're pushing down the glide slope. In the brief, discuss exactly what the pilot wants to hear, what he doesn't want to hear and how best to give him the proper information. *Coordinate* your efforts in order to get the maximum effect.

"Paddles contact, you're high and lined up right. Start it back to the left and keep the wake under your left shoulder. You got a ball?" Pregnant pause. "OK, you're looking good, don't settle through it, call the ball when you see it." Painful pause.

"Zero s-s-even, V-Vi-Viking b-ba-ball."

"Roger ball, Viking, nice pass." How's the vis out there? When did you pick us up?" ●

Lt. Bauermeister is aviation safety officer and landing signal officer for VS 37 at NAS North Island, Calif.

. . . Don't let the pressure to recover on the ship override a safe landing. If it can't be done, let them know and bingo to a divert field. There's always tomorrow or the next day unless you get foolish . . .

Wall Clouds and Tornadoes

By Mark Mabey

She was in fact, as well as in name, the "Pride of Baltimore" as she sailed northward to Baltimore after a 15-month European tour. When the weather turned sour her 12 crew members shortened sail to handle the heavy winds. Suddenly, and without warning, a wall of wind and water smashed into the schooner with devastating force.

The craft heeled over to port and sank. There had been no time to sound an alarm over the ship's radio. Three crewmen and the captain were lost, and after four days and nights adrift in a raft designed to accommodate six, eight survivors were rescued by a Norwegian tanker 335 miles north of Puerto Rico. They lived to tell about surviving the effect of a killer blast of 90-mph wind and water known as a "white squall."

Note the intense, rotating, sloping updrafts formed as this supercell thunderstorm draws air from many miles around into its massive convective structure.

A wall cloud is the lowering of the cloud base beneath the updraft section of a powerful convective storm. As the storm draws incoming air, a wall cloud usually develops beneath the base. If the incoming air has any initial rotating motion, it often forms an extremely concentrated vortex. As the vortex takes on a funnel shape, it dips toward the ground. The tornado becomes visible as moist air moves into the extreme low pressure vortex, condenses and sucks up surface debris.

The tornado, the most destructive of all small-scale convective pheno-

Supercell thunderstorm with wall cloud near right, lower cloud base, strong updraft tower, thick, sharp anvil at top. Massive, hard anvils of this type indicate a very strong convective structure capable of pumping massive volumes of air through the top of the storm. The anvil is produced by the strong high altitude winds blowing the cloud matter downstream.

mena, is a violently rotating column of air or pendant that forms out of the wall clouds. Local velocities may easily exceed 200 knots. The tornado may then remain stationary or move along the ground at velocities up to about 40 knots. Average ground contact time is approximately 10 minutes with a swath of destruction hundreds of yards wide and several miles long.

Mr. Mabey is a meteorologist with American Airlines.

The formation of a tornado is shown photographically as it develops from a pendant-shaped protrusion beneath the cloud base to full maturity and ground contact near Pampa, Texas on May 19, 1982.

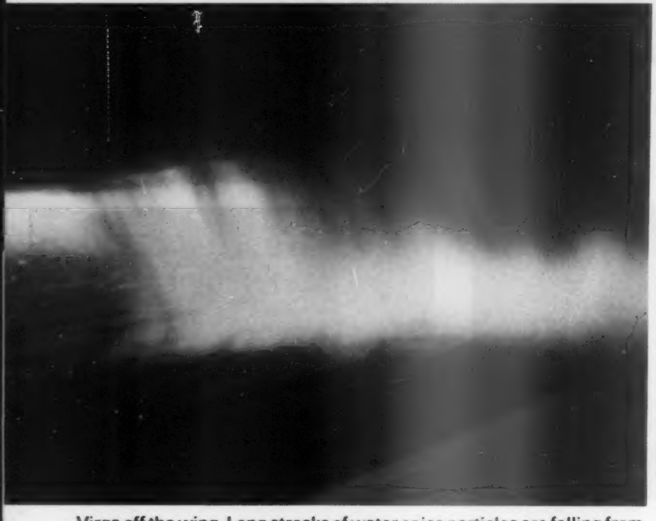
. . . The Delta disaster makes one well-defined point:

The Microburst at the DFW Disaster

By Dave Gwinn

18:04:18 — First Officer: "Lightning coming out of that one."
18:04:19 — Captain: "What?"
18:04:21 — First Officer: "Lightning coming out of that one."
18:04:22 — Captain: "Where?"
18:04:23 — First Officer: "Right ahead of us."

National Center for Atmospheric Research



Virga off the wing. Long streaks of water or ice particles are falling from the base of a cloud.

THAT conversation has kindled criticism of the crew of Delta 191 in the Dallas-Fort Worth (DFW) mishap. Why was the approach continued? Those five statements were certainly highlighted in the NTSB analysis:

"The captain (pilot) should have been well aware of the volatility of these storms . . . Either the first officer [copilot] or second officer [flight engineer] had ample time to inform the captain that they believed the approach should be discontinued. Therefore, the flight crew was responsible for the decision."

"Should have been aware . . . had ample time to inform the captain." We have here three men who were not threatened. Perhaps if conditions were more ominous than they appeared, they were expecting a safety input from one of many aviation support facilities. NWS? ARTCC? CWSU? Delta meteorologist? Let's consider it.

The aircraft entered the microburst 46 seconds after this conversation. That 46 seconds included 12 ATC communications from other flights that were monitored and rejected. It is unknown whether the captain was distracted and didn't try to use the radar. And, it is interesting that the L-1011's radar had had seven maintenance write-ups in the 60 days preceding the mishap.

nt: The decision remains in the cockpit, as always! . . .

Dr. T. Theodore Fujita, University of Chicago

Dry microburst. The wind pattern is revealed by dust at the surface.

LCdr. John E. Neander

Cumulus buildups.

With a range of 50 NM minimum, any display would have been tiny, of minimal use, and probably severely ground-cluttered with the parabolic antenna. The captain was monitoring, communicating, weighing experience and noting the absence of PIREPS. He had 46 seconds to reach conclusions. He had 29,300 hours, 30 years airline experience and nine type ratings. Was he dependent, in any way, upon inputs that he might expect, but no one was obligated to give?

At the time of the mishap there were *no* active

Beware of transmissions warning you of a "little rainshower" or an "itty bitty thunderstorm."

C. Clark, National Severe Storms Laboratory

Lightning, cloud to ground.

SIGMETS, convective SIGMETS, center weather warnings, severe weather warnings, severe weather alerts or local aviation warnings. Most pilots are aware of the rarity of severe wind shear encounters. Dr. Ted Fujita, Department of Geophysical Sciences, University of Chicago, states that they occur in no less than 1 percent and no more than 2 percent of all thunderstorms. Experience and the absence of PIREPS can contribute to complacency.

DFW was monitored by two separate radar facilities, NWS and the ARTCC CWSU. The observer at the former left for dinner 29 minutes before the accident and returned four minutes before impact. The observer at the latter excused himself for dinner 34 minutes before the accident and returned six minutes after. **No one** was using radar to monitor an explosive convective situation that met all wind shear indexes: temperatures above 80 degrees, dew points above 50 degrees, temp-DP spreads over 40 degrees (DFW Information Sierra: 50 SCT 210 SCT Temp: 101 DP: 67). The NTSB report describes the NWS absence as "other duties," and the dinner period of the ARTCC CWSU as "understandable." There were no defined communication or coordination requirements between these two facilities.

Lightning was seen by the tower controllers, but they didn't warn the flight crew. It is not their defined job, nor did they include within the ATIS the "towering cumulus — thunderstorms" alert from the ground contact observer. It was not a defined ATIS format in the remarks section. Lightning was also observed by a TRACON controller. When reported to a supervisor, the only concern was the potential electrical interruption within TRACON. Moments before the accident, controllers stated "little rainshower" and "little bitty thunderstorm" in transmissions to inbound crews.

The Low Level Wind Shear Alert System was silent. It remained so, even 10 minutes after Delta 191 was burning. Even then, the 46 knots measured did not meet defined NWS criteria (50 knots) to declare the storm "severe." The storm was first observed as Level I at 1752, and grew to Level III in four minutes (finally reaching Level IV); the NWS forecaster said, "I did not believe it was of sufficient intensity to issue an aviation weather warning. We seek ground truth [thunder-lightning]. We would not label a Level IV as a thunderstorm." Delta 191 provided the ground truth.

The Lear Jet preceding Delta 191 experienced a 30-knot speed loss and was blown from 1-dot up to 1½-dots down on the glide slope. He made no pilot report. Many pilots observed severe weather symptoms and made no pilot reports. Did they believe that more qualified observers also saw the obvious and would hasten to communicate? "The Safety Board concludes that the failure to provide the captain with . . . PIREPS was causal to the accident."

The Delta disaster makes one well-defined point: The decision remains in the cockpit, as always! It may be necessary that everyone's decision and communication responsibility be defined. Meteorologists are not ordered to communicate without specific well-defined parameters. "Ground truth" is a serious weakness in severe weather identification. Meteorologists taught us the symptoms of severe weather and wind shear. However, they are not required to act upon those indices. Of course, ATC controllers are not meteorologists.

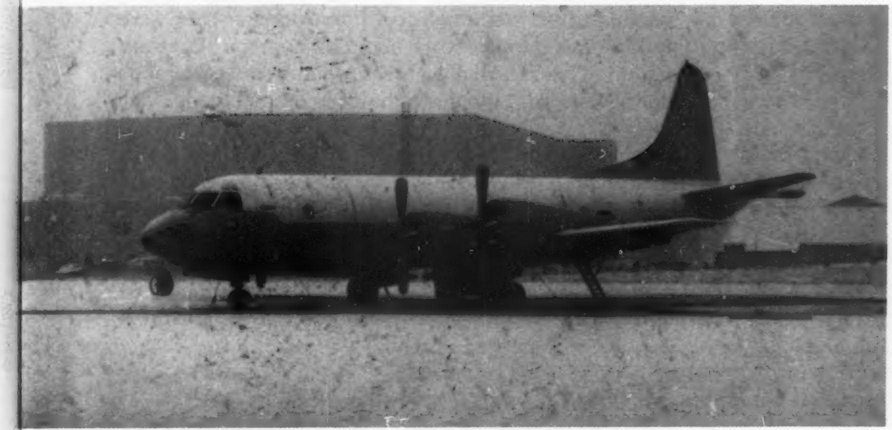
In *The Tragedy of King Lear*, the Jester reprimands the King: "If thou were MY fool, I'd have thee whipped . . . for growing old before growing wise." Lear's folly was to depend upon others for the security and support he had earned and deserved. He assumed too much! What was his due was not his to define. *Pilots don't have the privilege of growing old without wisdom.* And, like Lear, we see that *any dependency can contribute to disaster*.

We can not depend upon ATC, NWS, CWSU or TRACON to make or contribute to the in-flight decision. With Delta 191, the pilots bore the responsibility, even pilots on the ground, in the absence of PIREPS. Be thy brother's keeper . . . communicate. If in doubt, get out! Be suspicious. Be wary. Be alive.

Mr. Gwinn is a Kansas City-based airline crew member and training center instructor. He lectures on radar and wind shear to industry groups.

"So, Here I Sit Broken Hearted, But Alive"

By LCdr. Timothy Cepak



THE mission was critical; the maintainers had been working all night, and the "orange" surface action group was approaching the choke point. Time to get 'em. There were a couple of problems though: poor weather and an aircraft that was sick. Being hard-chargers with a reputation to uphold, we promised our task force commander that we could get the job done. Besides, we work better under pressure.

The first thing we had to do was get the aircraft ready. We had been having a problem keeping the fuel flow gauges working and had isolated the problem to a faulty power supply. That was the good news. The bad news was that there were none in the supply system. Using every favor the detachment had left, we obtained an RFI power supply from the "alternate supply system." (You know the one, when your aircraft comes up and someone else's goes down.) Now the aircraft was ready. Time to get the weather brief.

It always amazes me when I get a weather brief from the Air Force. I was prepared for a lecture from the staff sergeant about not giving them advance notice of our flight, but I was not prepared for what I got. "No, sir, I cannot give you a brief. The weather conditions are 200 overcast with a quarter of a mile visibility. We are shutting down the field." Well, I tried to explain to the man that I held a special instrument card that meant I could go regardless of the weather. He didn't buy it for a minute. So, there I was walking up the chain explaining to everyone our mission and my ability to take off in all kinds of weather. I know it was peacetime, and weather in this part of the world is doggy in the winter, but it was good enough to go. I finally heard what I wanted to hear, got my brief and clearance, and manned up the aircraft.

We were taxiing, and I was feeling really good. We were going to make our takeoff time. Then the rain started. I had never seen ice form so quickly on an aircraft. It was downright nasty. I figured that I could still safely take off if I could get airborne within the next few minutes and I was No. 1 at the hold short. You guessed it: "Expect a 15-minute delay for ATC clearance." OK, back to the line for de-icing, hoping the storm would subside. It didn't, so we didn't fly. I almost cried.

Don't think for a minute that I didn't think about blowing off the de-ice and trying to get my sky pig in the air with that layer of ice on it. Was I going to let the Air Force see me abort for weather when I finally got them convinced that I was an all-weather pilot? Was I going to let down my ground crew and abort? The answer was yes. The reason I was so sure I needed the de-ice was a sea story one of my old skippers told one day. Seems he took off from the midwest with a coat of frost on his wings. He almost lost it after takeoff because the ice made the aircraft too heavy. If he hadn't taken the time to tell me the story, I would have tried to convince myself that the ice was not that bad.

NATOPS gives you the guidance, but there is no little NATOPS elf that is going to walk out to your wing and say, "Yes, this is what I was talking about. Abort!" A well-placed sea story every now and then reinforces safety principles. So, talk it up guys. It can't hurt. You may sit there broken-hearted, but you and your aircraft will be around to cruise another day.

LCdr. Cepak flies with VP 22. He has served with VP 17 and VP 31, and has over 4,000 hours of accident-free flight time.

Hmm. Sounds like the Air Force weather guessers had it right all along — Ed.

Navy Pilots and Flight Officers in Civil Aircraft

By LCdr. Steve Bulwicz

Civil aviation provides a marvelous opportunity to enjoy the freedom of nearly unregulated VFR "fun" flying. You would think that an experienced military pilot would be just as responsible when flying a civil aircraft as a tactical jet, but that may not always be the case. Let me tell you a sea story about what happened to a couple of (imaginary) military pilots who were just plain inexperienced when it came to civil aviation.

Pilot No. 1. While I was on leave, I decided to visit a friend in the town where I went to college. Since it was a four-hour drive, I decided to head back to the old FBO where I worked as line boy pumping AV gas. If I could rent a Cessna 150 from there, I could save 2½-hours driving time and probably wouldn't even need a checkout.

The good ol' boys remembered me even though I hadn't been back in almost four years. They gave me "ol' Red," a vintage 1968 job, no questions asked. It was a nice day, so I grabbed a current sectional VFR chart and headed for "ol' Red." It took me a while to figure out how to start it since it didn't have a standard spring-loaded starter switch, but I figured it out and launched in the clear blue skies. Everything was looking real good at a cruising altitude of 2,500 feet. I spent the first hour of the hop playing with the VOR and looking at the scenery. Then a few unavoidable clouds started to pop out in front of me, forcing me to punch through a couple, but no big deal.

You guessed it — I punched into one and didn't come out. At this point I became painfully aware that I didn't even file a VFR flight plan, I didn't have any IFR publications and I didn't even know what the weather was at my destination airfield. Rather than turn around and possibly hit another aircraft, I figured it best to fess up to Center and beg for flight following while I descended to 1,000 feet. After a little wheeling and dealing on the radio, they granted it. "No sweat now," I thought to myself as I pulled back on the power and commenced the descent.

As I started to break out passing about 1,200 feet, I saw something red in front of me. I didn't like it, so I banked to the right, changing course about 30 degrees. As I broke out of the clouds, I looked to my left and saw a transmission tower protruding into the base of the clouds. Man, that was too close to think about!

I then advanced the throttle to level off and got no power response whatsoever. About this time I started to really feel that cold bead of sweat rolling down my lower back. Maintaining some of my cool (very little by now), I decided to make a quick scan of the cockpit. Behold, the mixture lever was pulled out to idle cutoff. Ramming it into full rich, I then waited the longest five seconds of my life hoping that the windmilling propeller would catch. Vroom — I was saved. I must have pulled the mixture out instead of the throttle when I began the descent.

I picked up the airport visually, thanked Center for their assistance and landed. Needless to say, before I headed home I gave myself a thorough preflight briefing covering even unanticipated contingencies, invested in some IFR pubs, triple-checked the weather and had an uneventful ego-boosting flight home.

Pilot No. 2. It had been a long deployment, with not much summer remaining on return to CONUS. Some friends and I had planned a flying backpacking trip to a national park during the post-deployment leave period. Unfortunately, the date set for departure was not flexible due to leave blocks. We hoped for good forecast weather, but it didn't turn out that way. A group decision was made to file and launch over the mountains IFR since I had just been checked out by the club certified flight instructor. It was over the mountains that the "light forecast rime ice" began to accumulate on the wings and struts.

The following is an abbreviated text of our cockpit communication:

"Hmm. We're already at 12,000 feet, the terrain is at 9,500 feet, we don't have oxygen, we don't have a turbocharger. I guess we'll just press on and hope to fly out of it soon."

A few long, paranoid minutes later, "All right, we're VFR again."

"No sweat, but look — our groundspeed is a lot lower than we planned for. Man, it's going to take an extra hour to get to our airfield."

Motor, motor, motor.

"Copilot to pilot, we need to stop at the next airfield or else I'm going to explode."

"OK, let's buzz in."

"Do we need fuel?"

"No, this baby's got long-range tanks. Besides, we've got to get on the trail before dark, let's hustle."

Vroom.

"We're out of here."

We cleared the next set of famous mountains VFR with no problem, and we descended into our destination for the three-day jaunt. It was a great outing — sunshine, rain, snow, gale force winds and bone-chilling cold. (It was better than night carrier landings, anyway.) Walking out to the aircraft, we were pleased at its appearance and patted ourselves on the back for our proper tie-down work. We then decided to take a look into the fuel tanks to see how much we really had remaining.

"Uh, oh, there ain't near as much as we thought. The nearest gas station is 25 miles the opposite way."

"Well, shoot — let's go for it and hope we don't flame out."

We made a successful flight to the pit stop, refueled and found that we had at least seven gallons (30 minutes) remaining. For the return trip, we decided to cross the mountains perpendicularly again, only this time at max gross weight. Level at 10,500, we made the first of several runs at the mountains.

"Look at the airspeed — it's going down."

"So's the altitude."

"Watch those peaks! Let's turn around!"

"OK, OK, no sweat. We can try again at 11,500."

"Yeh."

Motor, motor.

"Airspeed's going down, so's the altitude — watch those peaks! Let's turn around again!"

"OK, OK, no sweat. She doesn't want to climb any higher than 12,200."

"Let's go for it anyway."

Motor, motor.

"Airspeed's going down, so's the altitude."

"I think we'll make it."

"Watch out for those 9,700-foot peaks."

"No sweat."

"Hey, look at the airspeed, it's climbing like crazy."

"Yeah, so's the altitude. We're up to 13,500. Feel OK?"

"Yeah, but as soon as we can get lower, we should."

"Agreed. Those clouds up ahead are in the way, but we should be able to punch through 'em if we have to." Punch one, punch two, punch . . . "Hey, we're not coming out. Airspeed's decreasing, altitude's decreasing. We're starting to pick up ice, hey . . . the engine sounds funny, we're losing power!"

Right about here we started to sweat.

"Quick, pull out the carburetor heat . . ."

Vroom and poof over to the other side and we're VFR over the flatlands. There was silence for the next 60 minutes in the cockpit. Then we heard a voice from the rear of the aircraft: "I guess we've been taking jet engines for granted."

These two ficticious crews obviously escaped death, but by how much? Unfortunately, similar stories are regularly repeated in the general aviation community with no one the wiser, and could be responsible for a large percentage of their mishaps. For Navy aircrews taking part in general aviation, some wise things to do before launching include taking a good hard look at the things that will severely affect a light aircraft flight: inadvertant IFR, any icing conditions, head winds, high terrain, aircraft service ceilings, oxygen requirements, power availability, mountain wave turbulence, emergency procedures, publications and more. It almost sounds like a NATOPS preflight briefing guide, doesn't it? As with any cross-country flying, get-there or get-home-itis affects your better judgment.

It's no fun to wish you had taken the bus when you're out of airspeed, altitude and ideas. ●

LCdr. Bulwicz is currently the COMMATVAQWINGPAC staff safety officer at NAS Whidbey Island, Wash. Previous squadron tours include VAQ 139, VA 145, VA 304 and VT 86.

... There are no peacetime missions that require you to expose yourself to the dangers of a full-blown thunderstorm ...

Thunderbumper Time

By Lt. Col. Rich Dinkel, USMC (Ret)

DON'T you wish you had a dollar for every thunderstorm lecture you've attended? A guy has to be pretty dense not to know the dangers of hail, turbulence and lightning associated with the big "bumpers." Right? **Wrong!**

Every summer brings on a whole new crop of aviators who were bored at their squadron foul weather lectures, and who have subsequently managed to increase the Naval Safety Center's data bank on mishaps caused directly or indirectly by thunderstorms.

Of course, nobody in their right mind wants to be shaken by turbulence until their fillings loosen. Nobody wants to get belted by hail until the leading edges of their flying machine look like a terminal case of acne. Nobody wants to get struck by lightning. Why then, do statistics continue to prove that despite all this well-meant advertising, pilots still become involved with these powerful giants of the sky? There are at least four reasons.

First, he may not see the storm. These deadly beauties sometimes come all dolled-up in cirrus and altocumulous dressings and, like the mythical Sirens, can beckon the unwary toward a very rocky fate.

Second, he may not understand or believe the briefings he's had or the *Meteorology for Naval Aviators* when it said that hail may be encountered not only in the thunderstorm itself, but also five to 15 miles on the downwind side of the storm.

Third, he may feel his mission requires him to risk damage and destruction, and he will press on despite his knowledge of the hazards. Or he may be in a hurry to get home.

Finally, he may have taken off with incomplete weather information and found himself boxed-in by weather that he could have avoided if he had just paid a little more attention to the detailed preflight weather briefing. Regardless of the reason, all pilots coming away from a

. . . Regardless of the reason, all pilots coming away from a hail or lightning strike will swear that they will *never* do that again . . .

hail or lightning strike will swear that they will *never* do that again.

Most sane pilots have a healthy respect for thunderstorms. Few of us would be foolish enough to penetrate a big one for the "fun" of it. It's interesting to note, though, that damaging hail and lightning often occur outside the actual storm cloud. The Air Force reports that about half of all USAF hail damage has occurred in the clear air surrounding the storm, particularly underneath the overhanging cirrus anvil.

Powerful updrafts spit the hailstones up through the clouds in the cell. Some are spewed back into the cell. Some are spewed out the top and the sides to fall through the surrounding clear air. In many cases, the high-altitude winds are much stronger than the low-level winds; and the cell becomes tilted forward (the top leaning downwind), allowing hail to drop many miles ahead of the storm. PIREPS have reported hail up to eight miles from the upwind side of a nasty "bumper" and over 15 miles from the downwind side.

The turbulent churning and intermingling of raindrops and ice crystals in the severe updrafts and downdrafts of an active thunderstorm produce strong electrical fields in the clouds. When the intensity difference between the two charge centers exceeds a certain particular value, a violent discharge takes place in an attempt to equalize the charges. This discharge is lightning.

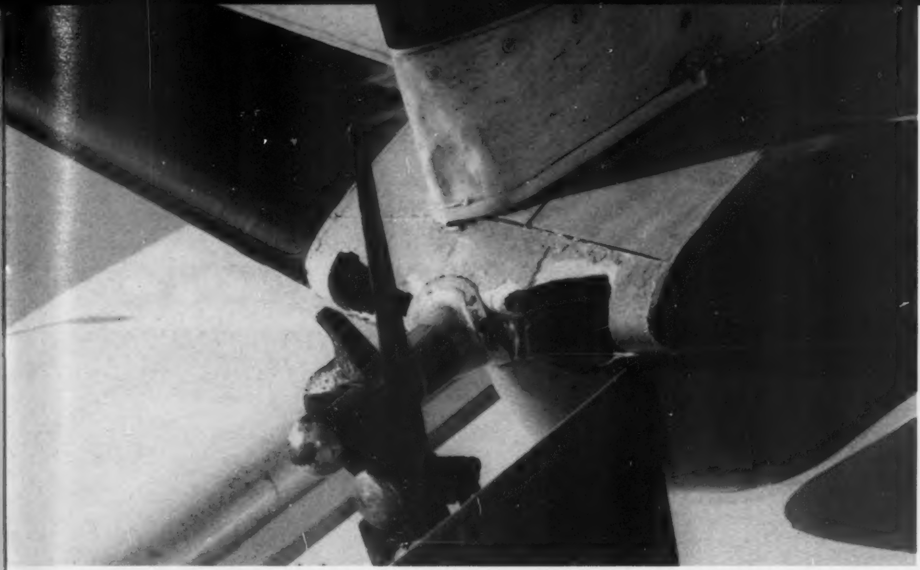
Studies show that when lightning strikes an aircraft, a

complicated and occasionally random series of events takes place. The aircraft acts like a conductor, and injury to occupants is considered unlikely. Direct damage is usually slight. Occasionally, a lightning strike will cause severe, temporary impairment of the eyes and ears. There have been cases where nearness to a direct strike by lightning has induced secondary currents that have inadvertently actuated electrical circuits (i.e., external tank jettison, pylons release, activation of fire bottles).

Until someone comes up with a "thunderbumper abatement procedure," we'll just have to try to avoid trouble.

● Plan ahead. Get a complete weather brief before takeoff, and don't be afraid to get an update or two once you're airborne. Pass a PIREP if you find something other than forecast. Thunderbumpers are more often a surprise to the pilot than to the weather guesser. They are infinitely more dangerous to the pilot. If it doesn't look as though you will be able to avoid them, **don't go**!

● Learn where the hazards usually are. Can you honestly say that you have read a text or full-length article on weather since you left flight school? Once armed with a good knowledge about thunderstorms, most pilots will ensure that they give them a wide berth.



If you are airborne and find yourself in a cirrus layer unable to see where the big ones are, don't just sit there! Get on the horn for another altitude or some radar assistance if you don't have an on board weather avoidance capability. Be sure to find out if the center controller is using his basic "skin paint" scope or his fancy IFF display scope when he says there is no significant weather in front of you. He can't paint weather on his IFF display scope, but he's likely to be using it at the time because it's easier for him to keep track of his traffic on it if it's busy. Whatever you do, don't blindly cruise along until it suddenly gets very dark. By then, you're already in trouble.

If you still persist in the idea that your mission requires you to risk hail and lightning damage by flying your machine into or near thunderstorms, you'd better check with your CO. He'll be glad to set you up for a visit to the "talking doctor," or help you process your paper work for a transfer. There are no peacetime missions that require you to expose yourself to the dangers of a full-blown thunderstorm.

Sure, there are times when you've just got to do it such as a weather divert to an air patch with lots of CBs in the area. Nevertheless, thunderbumpers are bad company. By planning ahead, we can avoid a lot of gray hairs by going around them or even staying on the ground.

Should we find ourselves in an area of intensive, unpredicted thunderstorm activity, we can reduce the likelihood of damage due to hail, lightning and turbulence by acknowledging the threat and avoiding the clouds and cloud portions that contain the greatest risk. Finally, if we've screwed it up so bad that we have no choice but to penetrate a big one, we can mentally prepare ourselves to be ready to fly with possible instrument, radio and perception problems. In this particular case, experience is *not* the best teacher. ●

Lt. Col. Dinkel retired in November 1986 from the Marine Corps and now is strike project manager for Veda Corp., Warminster, Pa. His final USMC assignments were executive officer and director of safety and standardization, Marine Aviation Weapons and Tactics Squadron 1, MCAS Yuma, Ariz., and aviation safety officer, 3rd Marine Air Wing, El Toro, Calif.

Withholding Information

By Carter Weisiger

THUNDERSTORMS had been in the area all day. They were of the larger variety, black and foreboding, dispensing torrents of rain and driven by 25- to 45-knot gusts of wind. As soon as one completed its passage over the field, another took its place. The line seemed endless. The only respite was the lull between them.

During a lull an intrepid, experienced pilot (close to 5,000 hours) fired up a TA-4J for a cross-country to the coast with a fuel stop en route. The pilot was fully qualified, current, and the Scooter was in good shape. The aircraft had flown the day before, and the previous pilot noted no gripes, nor were there any outstanding discrepancies on the aircraft.

The pilot received a weather briefing which was: 10 SCT, E20 BKN, 40 BKN, 80 OVC, 6 TRW-F, ALT 29.81, TOVHD MOVG SW, OCNL LTGICCC, DARK E-S, CAWW IN EFFECT TILL 1530Z. Thunderstorm Condition I was in effect at takeoff, but the CAWW in effect did not include the departure point or the pilot's proposed route of flight.

Preflight and start were normal, and the pilot called for taxi information. The wind at the time was south at 8. The duty runway was 32R, but there was a big build-up of clouds directly off the upwind end, so the pilot requested 32L. Ground control cleared the pilot to taxi to 32L. The pilot called the tower for takeoff clearance but was unable to raise the tower. He switched back to Ground, was given the wind again, assigned a departure frequency and cleared to go.

The aircraft began to roll, line speed check was good, and as the pilot was almost ready to rotate, a number of birds began leaving the runway. At the 3,500-foot position a large flock of birds rose in view. The pilot heard a loud thump, and the engine began to unwind. The pilot pulled the throttle to idle, dropped the hook and broadcast he was aborting. He used maximum braking while giving priority to directional control. He saw the wires pass under the aircraft but felt no deceleration. *They weren't rigged!* The aircraft was slowing but not quickly enough to keep from going off the end of the runway. The *Scooter* almost buried its nose in the sand and mud and came to a stop after penetrating the field boundary fence. The pilot blew off the canopy, unstrapped and egressed from the aircraft uninjured. He saw a large flame coming out of the exhaust, shooting into the air about 20 feet — like a blow torch.

Witnesses, including the crash crew, saw flames at the point where the pilot began to abort. The driver of the runway alert truck on the hardstand saw the flash and began rolling before he was told to. Approaching the aircraft he could see it was on fire. The crew was ready to extinguish the fire as soon as they got into position. It didn't take them long to put the fire out.

Some very vital field information was never passed to the pilot. There was no cautionary advisory that there was standing water on the runway or that the arresting gear was not rigged. That's no way to run an airfield. Pilots need this vital information whenever conditions warrant it and water, birds and derigged arresting gear constitute such conditions. ●

Mr. Weisiger is a former staff writer for Approach.

Stork with help from flea presents:
BROWNSHOES IN ACTION COMIX
"The kind real aviators like"
Contributed by Lt. Ward Carroll, VF 32
"We're manning up our fighters for the afternoon go; I've got my gougest RIO for the radar locks, you know. Strapping on my airplane with the Martin-Baker seat, crank the Pratt and Whitneys; Jee, the whine sounds pretty neat."
The following is a presentation of
the all-safety network
BOOM, BOOM, BAM!
BOOM, BOOM, BAM!
Any day now, Champ . . .
THE KID
OPREP-3 "Weather rap" meet OPREP-3 Koch Fitting Records.
"The weather guessers forecast sounded crummy, this is true, we had to gaff him off though 'cause the sky is nice and blue. We'll just be gone an hour. Hey, that's just a little while; the Tomcat chugs the JP like it's going out of style."
Instrumental part
Another round, barkeep
BOOM, BOOM, BAM! BOOM, BOOM, BAM!
SCREECH!
OPREP THREE
(THE THUMBS UP)
It's Miller time, the Bogey's killed, the jets are RTB; but what is this? The field is closed?! No Happy Hour for me. The thunder boomers slamming hail all over the place; it looks like we're diverting to an Air Force base . . . (With egg on our face.) (We forgot our approach plates.)
Yes! That's the new one from "OPREP-3." If you missed their concert at the NATOPS review conference don't despair. They'll be warming up "bird strike damage" on the first leg of their upcoming U.S. tour. This portion of safety television has been sponsored by the folks at Face Curtain Locking Tabs, Incorporated.
OPREP-3 "Weather rap" meet OPREP-3 Koch Fitting Records.
BOOM, BOOM, BAM!
I've seen those guys live before. They were pretty good. The stage was shaped like a giant helo dunker.

Sailors . . . say the weather is a great bluffer. I guess the same is true of our human society — things can look dark, then a break shows in the clouds, and all is changed.

E.B. White